Griffiths' guide to the iron trade of Great Britain

Samuel Griffiths











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## GUIDE

TO THE

# IRON TRADE OF GREAT BRITAIN

BY

SAMUEL GRIFFITHS

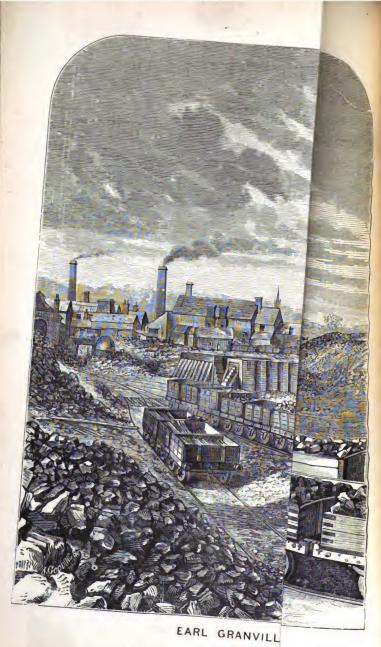
Editor of 'The London Iron Trade Exchange'

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# GRIFFITHS' GUIDE

TO THE

# IRON TRADE OF GREAT BRITAIN

WITH PLATES AND ILLUSTRATIONS

CONTAINS

An Elaborate Review of the Iron & Coal Trades for Last Year

## ADDRESSES AND NAMES OF ALL IRONMASTERS

WITH A LIST OF BLAST FURNACES, IRON MANUFACTORIES,
AND OTHER STATISTICS AND INFORMATION
RESPECTING IRON AND COAL

which may be useful to

MERCHANTS BANKERS

\* BROKERS

COALOWNERS IRONMASTERS

AND ALL OTHERS INTERESTED IN THE IRON TRADE

BY

## SAMUEL GRIFFITHS

Editor of 'The London Iron Trade Exchange'

#### LONDON

PUBLISHED FOR THE PROPRIETOR, 133 CANNON STREET

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SCY TOM Widel Verren

## DEDICATION.

TO

# Sir Sydney Hedley Materlow, Baronet,

LORD MAYOR OF LONDON.

My Lord,

Although your LORDSHIP is not directly connected with the Iron Trade, the vast importance of its interests to the prosperity of these Kingdoms is well understood by your Lordship, and must be my apology for availing myself of your sanction to dedicate 'The Guide to the Iron Trade of Great Britain' to the Chief Magistrate of the first commercial City in the world.

Although the Coal and Iron Mines and Furnaces are fixed at a considerable distance from your Lordship's jurisdiction, the capital necessary for their development, and the merchant princes who serve the craving nations of the earth with Iron, are mainly located in this great Metropolis. Without the Bank of England, Messrs. Glyn's, and other establishments of a kindred nature, it would be difficult to arrange the great monetary exchanges required, and, indeed, absolutely necessary for firms engaged in the Coal and Iron Trades with foreign countries.

We are indebted in no small degree for the gigantic proportions which these trades have assumed in the civilised world to the banking facilities afforded by, and the known probity and high honour of the Bankers and Merchants and Brokers of the City, which, of its own free will, called your Lordship to preside over its ancient municipality, and dispense, as yourself and predecessors have done, the civic hospitality to the mightiest potentates of the earth.

Permit me, my Lord, to offer a fervent prayer that your life and health may long be spared, and that you may continue to act under the empire of the motto on the façade of the Royal Exchange, which I also acknowledge—' The earth is the Lord's and the fulness thereof,' and to attribute in the very highest degree our prosperity as a nation to our belief in these inspired words.

I remain, with profound respect, Your Lordship's

Most obliged and humble Servant,

SAMUEL GRIFFITHS.

84, CANNON STREET.

## PREFACE.

THE pages of the 'Guide to the Iron Trade of Great Britain' have been inspired under the impulse of a strong desire to afford practical information to the London and Liverpool merchants whose business operations bring them into frequent contact with the producers of the most important staple manufactures of the United Kingdom. The author is well aware that the task might have been performed by others more capable of doing justice to it than himself. However, as the necessity of a Guide to the Trade at this juncture is admitted on all hands, he has with diffidence undertaken the responsibility; and craves indulgence and forbearance from those who may be disposed to cavil with the Guide, which is not as perfect in detail as the author could wish, notwithstanding the assiduous labours which have been bestowed upon it. The great object of the author in this work has been to exhibit the grandeur of our great staple, and by the accumulation of patent facts, show the important position we occupy throughout the world in the manufacture of Iron and other metallurgical industries. Should this first effort be well received, every exertion will be made to render the Second Edition more perfect and acceptable. The work, as it now stands, is offered to a discerning public, by whose verdict the author will be content to abide.

S. G.

## INTRODUCTION.

I FEEL that an apology is justly due from me to the Subscribers to the 'Guide to the Iron Trade of Great Britain' in consequence of the delay which has occurred in the publication since its advent was first announced. Deeply as I regretted this shortcoming, notwithstanding my untiring efforts, I am grieved to say that unavoidable difficulties, and obstacles insurmountable and beyond my control, prevented an earlier publication. In the first place, the returns necessary to complete the statistics were delayed, perhaps not willingly, in various quarters. In the second, the plates and engravings which it was from the first intended should accompany the work, were often delayed, and frequently required to be abandoned for more truthful and correct representations. In the third place, the editorial labour exacted from me by my old 'Iron Trade Circular,' now called the 'Iron Trade Exchange,' has increased fiftyfold this year, which made imperative demands on my time, and large inroads on the leisure hours which otherwise would have been willingly

consecrated to the 'Guide.' In the fourth place, as the 'Iron Trade Exchange' is emphatically a subscription newspaper, and all subscribers thereto are entitled by their subscriptions to receive answers to all letters demanding information on any subject in respect to the Iron Trade, my personal attention in dictating replies to these applications, particularly when the Foreign Mails came in, was and continues to be absolutely necessary. These pressing engagements, with my general business as a merchant and metal agent, so thoroughly occupied my time as to render the task of completing my book difficult; and I can with truth say that the above causes and obstacles are entirely accountable for the delay, which has often vexed and annoyed me.

It formed no part of my original intention to write a scientific essay on the manufacture of Iron and Steel. I have therefore adhered from first to last, in the pages of the 'Guide,' to my original programme in this respect. A book of this character would of necessity occupy two or three volumes; and as Mr. Lowthian Bell, Mr. Henry Bessemer, and Sir William Fairbairn, have so ably served the Trade in this respect, I have confined myself more to short histories, practical hints and sketches, and patent facts and statistics in connection with the Trade and the art of Iron-making; which, while they do not involve any particular modus operandi, may be interesting and, I hope, beneficial to Merchants and Ironmasters in all departments of the Trade.

Anyhow, this has been my design and object in the pages and illustrations which I offer with no small degree of diffidence to the Trade and the public.

The Review of the Iron Trade for 1872 has been written with care. The statistical facts embodied therein the author hopes may be useful as a reference. The Commercial Review for the same year will be found consistent with the facts developed in the extraordinary volume of demand which created such a revolution in prices as will stand for ever as the crowning incident of the Trade for 1872. All these leading facts I have, to the best of my knowledge, truthfully recorded.

The grandeur of our position as an Iron-making country has always been present to my mind; and although the 'Guide' frequently dilates with pride on our unrivalled produce of Iron and metallurgical industries, I have endeavoured to avoid comparisons with other countries which would have raised our Iron-masters in their own estimation at the expense of foreign competitors. I firmly believe that the enterprising leaders of the great industries of all nations are being, as it were, involuntarily drawn nearer together in fraternal ties, and that as civilisation progresses the interests of all countries will be found to be more identical and prosperous all round in proportion as brotherly feeling is cultivated, ministering continually, as it will, by interchanges of thought and good offices,

and thus inspiring us constantly to instruct each other in the perfection of art, which is the handmaid to progress, civilisation, and social happiness. My statistics in regard to the blast furnaces will be found in their-proper place, and the quantity of Iron made in 1872 not far off the mark.

With regard to my statistics of the puddling-furnaces, they are as perfect as they could be made under present circumstances. The revolution now going on in puddling is more general than those confined to one works in one locality would expect or believe. Numbers of Danks' and Casson's furnaces have already replaced the old furnace, and others of this class are in rapid course of erection.

This, with other circumstances, has rendered a list of the puddling-furnaces, at work and standing, perfect and complete, impossible. At the same time I hope my statistics in this respect will be considered satisfactory. I have to acknowledge with gratitude statistical and other information willingly afforded by Mr. Robert Hunt, her Majesty's custodian of mining records at the School of Mines. I am likewise indebted to Mr. Henry Bessemer for information personally given to me in regard to his wonderful process, which we all admire for the beneficial revolution it has effected in the Trade. I must also acknowledge my indebtedness to my late friend, Mr. Beecroft's book, from which I obtained valuable information in regard to mensuration, weights, and strength of materials, &c.

I am under the same obligations in regard to Scotch Iron to Messrs. Feldtman, the old Iron brokers of Glasgow; and for ancient statistics in regard to Scotch Iron both in respect to price and qualities I am indebted to my old friend Thomas Thorburn, of Glasgow.

I have heartily to thank the Ironmasters and Manufacturers of England and Scotland for the polite manner in which the portals of their establishments have always been opened when my visits, which have been numerous, have been made, and hope that my reports of anything I may have seen have been consistent with discretion, in sometimes suppressing the publication of new discoveries in machinery which, from the just claims of private interest, ought not to be divulged. I may, without fear of contradiction, say that I have visited as many Iron Works and metallurgical establishments in this and other countries as any man living, and never was refused admission but once in my life. Only the other day I was permitted to look over the Patent Nut and Bolt Company's London Works, where, according to my view, the greatest wonders in England are performed by their patent machines. Indeed so marvellous were the results of the working of these machines, that I could not have believed it possible from any other evidence than my own eyes.

In conclusion, therefore, I must be permitted to

acknowledge with gratitude the kind and polite attention I have invariably received in these numerous visits of general observation at our Iron-making and great metallurgical establishments, which perform so important a part in their ministrations to the wealth and stability of these kingdoms.

## 1. OBSERVATIONS ON THE QUALITY OF IRON.

THE quantities of all other metals consumed, when compared with the consumption of Iron, are infinitesimal; and if we remember, as we ought to do, that hundreds and thousands of precious lives depend entirely on the quality of the Iron used in the Iron rope or chain of our coal-pits, railway engines and trains which cross the country so rapidly, our steam and merchant ships which plough the Ocean and make perilous voyages to all parts of the world-all depend upon the quality of the Iron of which they are constructed, which, if of inferior quality, involves great sacrifice of human life. We could give particulars of pit chains snapping, boilers blowing up, coupling links of railways giving way, the plates of Iron steamers rip ping up, crank shafts and piston rods breaking, all and each involving sacrifice of human life, the recital of which would be heartrending if particularised in these pages. We have paid particular attention to boiler explosions, and can never forget the painful sensations produced on our mind while witnessing the scenes of slaughter and death created over the last twenty years from these causes. The last we saw was Wells of Moxley. We hope we may be spared from witnessing another catastrophe so terrible as this. We believe that if engineers would be more particular in the brands of Iron used these accidents would be much diminished. It is rather a singular

fact that we never heard of an ordinary boiler bursting that was made with Lowmoor and Bowling plates, or the plates of a ship ripping up, to the destruction of the vessel and all on board, such plates having been obtained for the said ship entirely from respectable highestclass makers. Such a thing never occurred, and never will occur; -it never could occur, for Bowling, B.B.H., Lowmoor, Earl Dudley's, Snedshill, W. Millington & Co., and S. C. Crown plates might bend with the elementary forces of storms and obstructive rocks at sea, but the hardest rock on which a vessel may be stranded, made of the above plates, could never perforate the hull, or break the plates, or rip the seams. We say this is impossible; hence the importance of our endeavours to impress on the minds of capitalists and engineers how and from whom they may obtain Iron of this class with the view of protecting and saving the lives of the travelling public, who rely on their name and fame for safety. These precautions are paramount because of the difference in the value and quality of Iron. Lowmoor and Bowling to-day are from 30l. to 46l. per ton, according to size and weight, whereas other qualities of the lowest class of Iron, by the lowest class makers, even in Staffordshire, can be bought at 15l. per ton; and as it is impossible to tell what Iron is worth without testing and trying it, the margin in this wide range of value is so great that we believe nothing would be more advantageous to engineers and capitalists than a better knowledge and history of the name, fame, and integrity of the old and highly respectable houses in the Trade, particularly in Staffordshire and Shropshire. An account of the process adopted at Bowling will be found in this book, and if inexperienced people will ask any experienced Ironmaster, they will be told that Bowling and all other high-class Iron made in Yorkshire and Staffordshire is worth all the money it fetches in the market, much more so than the large quantities of rotten, almost useless cinder Iron made and sold at many pounds per ton less than these brands. It is a fact that large quantities of Iron are made at certain works from nothing but Cinder Pigs-that is, Pig Iron made from cinders alone, by remelting them in the blast furnace. This is very strange—nevertheless, quite true. Our object in the 'Guide' has been to point out the best makers of Iron, so that engineers and merchants may be enabled to obtain it through the proper channels and by this means avoid a fearful sacrifice of human life, and a loss of reputation alike to the innocent engineer, and, sometimes, to the merchant who has, perhaps, been deceived.

## CONTENTS.

#### CHAPTER I.

#### REVIEW OF THE IRON AND COAL TRADES FOR 1872.

Increased value of Iron, which has been doubled during the last eighteen menths-Quantity of Iron made; quantity exported. The consumption by Foundries, and the quantity used up in all kinds of metallurgical manufactures-The gross amount of Coal and Ironstone raised in the United Kingdom, and the quantity of Coal consumed in Ironmaking and metallurgical industries-Money value of the Iron produced, compared with Tin, Lead, Copper, and all other metals-B. B. H. Bar Iron advanced during the last eighteen months 81, perton, or double in price-Make of Pig Iron in 1872-The same for 1871 -Increase exhibited-Total value of Pig Iron made in 1872-Data given for calculation-Quantity of Coal consumed for smelting to make Pigs-Quantity of Coal raised in 1871-The same for 1872-Quantity of Coal consumed in Iron-making of all kinds, Bessemer Steel, Tin Plates, all metallurgical manufactures, and steam generating purposes-The charge of conspiracy against the Coalowners proved to be groundless-Produce of Scotland falls off-Cleveland increases-Total export of Iron and Steel-Ditto of Pig Iron-Table showing exact reduction of stocks at the Works and Foundries-Quantity of Pigs used to make Malleable Iron and Bessemer Steel-Ditto for Tin Plates - Quantity ditto by the Foundries of the United Kingdom-The quantity given of the Malleable Iron and Steel used up in the United Kingdom for Shipbuilding and all other metallurgical trades-Synopsis Table exhibiting stocks of all kinds, named in these industries: Cut Nail Trade, Shipbuilding Yards on the banks of the Clyde, Steam Ships, Floating Docks-Great importance of the Iron Trade as a national industry-Causes of the present high prices-Quantity of Iron Ore raised in 1872-Dud Dudley -Cort-Mr. Darby-Mr. Darby's Inventions-Bessemer's great Invention described-Number of Bessemer Works-The Great Steel Company on Bessemer's system .

#### CHAPTER II.

#### COMMERCIAL REVIEW OF THE IRON TRADE FOR 1872.

#### CHAPTER III.

#### BARROW-IN-FURNESS.

Barrow-in-Furness—History of the ancient Iron districts of Barrow and Sussex - Old furnaces, cinders, and works - Archimedes destroys the Roman Fleet under Marcellus by iron appliances, lifting the Roman ships, as Marcellus says, 'like buckets of water'--History of the ancient Bloomeries at Barrow-Description of the present state of the Coliseum at Rome, from a personal inspection -The Emperor Vespasian obtained Ore from Elba to make the Iron used in its construction-Julius Cæsar, or Agricola, probably improved upon the mode of making Iron in use by the ancient Britons prior to the Roman invasion-Cort's invention of Grooverolls and Puddling-Mr. Joseph Hall's discovery of the Boiling Process in Puddling-Abandonment of Sand-bottoms-The Bessemer process explained-Great Barrow Steel Works-Their gigantic extent, the Docks, Jute-mills, Mines, and the great Shipbuilding Yard of the Company, amply and accurately described-The amount of Steel and Iron manufactured—Coal consumed—Number of men employed-Total Annual Value of the Steel and Iron made-Market Value of the Ore raised-Demidoff of Russia, Krupp of Prussia, and Schneider of Creusoux, left far behind-Supremacy of England in Metallurgy-Mr. Fairbairn on Tensile and Tortuous Strains -Elaborate Synopsis of Fairbairn's analysis of Barrow Hæmatite Ore . PAGE 33

### CHAPTER IV.

#### SOUTH STAFFORDSHIRE OR THE 'BLACK COUNTRY.'

Early history—Topography of—Manufactures and the Towns therein—Soho Foundry—Patent Nut and Bolt Company, and Joshua Horton's great Boiler Yard at Smethwick—Chance's monster Glass Works—Oldbury in smoke, noxious gases, lighted up at night by numerous furnaces which encircle it—Dudley and Sedgley, with their Manufactories—The Priory, with its oasis—Dudley Castle; the grounds opened by the Earl of Dudley to the Ironworkers—Brierly Hill and Stourbridge Firebricks and Retorts . PAGE 45

#### CHAPTER V.

#### THE RISE AND PROGRESS OF THE STAFFORDSHIRE IRON TRADE.

Rise and progress of-Late Mr. Abraham Darby introduces Coal for smelting Iron-Dud Dudley's successful labours to carry out smelting with Coal-Mr. John Wilkinson, Mr. Foley, Mr. Parker, the early pioneers in Staffordshire-The beginning of Quarter Days-Short Sketch of the late Mr. James Foster-The same of Mr. John and Mr. William Bagnall, the founders of Goldshill-The same of George Benjamin Thorneycroft, founder of the present great firm—Commencement and progress of the Chillington Works, with exact particulars and present dimensions-Short Sketch of the late Mr. William Hanbury Sparrow, with some particulars of his useful life, his wealth, &c .- Addenbrookes the oldest Ironmaster family in Staffordshire; their patent to utilize the Gases inspected by author in operation at Dalmellington-The Earl of Dudley's Round Oak Works-Brand and Quality of Iron-Immense Coal and Iron Mines in the Earl's domain described-W. Barrows and Sons, of Bloomfield-How they make the best Iron, and keep up their brand of B. B. H. - W. Dawes and Sons, of Bromford-Sketch of the Minerva Iron Works and the proprietor, Mr. Isaac Jenks, Mayor of Wolverhampton-William Hunt and Sons, of the Brades, the oldest Steel Works-Mr. John Marshall of the Monway Works, and Mr. Henry Mills of the Victoria Works, the makers of Gunbarrel Iron to the Government by appointment-Great Foundry and Engine-shops and Iron Works-Biographical Sketch of the late Samuel Lloyd-Great Patent Shaft and Axle-tree Company-Wm. Russell and Sons, Locomotive and Gas Tube Works; Mr. Smith Managing Director-T. and J. Roberts' great Foundry-The timehonoured Horsley Works and Foundries for Steam-engines, PAGE 50 Bridges, &c. . . .

## CHAPTER VI.

BILSTON, AND ITS VALUABLE COAL AND IRONSTONE MINES.

Qualities and kinds of Coal and Ironstone—Immense value of an acre of land on which St. Leonard's Church stands—Coal Beds, formerly here the most valuable in England, have been exhausted in this district: no less than 41,440l. for a single acre—Patent Nut and Bolt Company, Limited, most extensive in United Kingdom—Particulars of their London Works near Birmingham—Their great Stour Valley Works—Their Iron Works and Rolling Mills at Westbromwich—Their Blast Furnaces, Rolling Mills and Works, at Cwm Bran, near Newport, Monmouthshire, South Wales. PAGE 80

#### CHAPTERS VII. AND VIII.

THE BILSTON MANUFACTURES: ITS CEMETERY ON THE COAL MINE BANKS, AND WOLVERHAMPTON.

Manufactures of Bilston-Colliers and Ironworkers industrious and well-behaved-Sketch of the last Strike and Lock-out-History of the settlement of these disputes-Bilston surrounded by Iron Works and Foundries-T. Perry and Son's Highfields great Foundry and Engine Works-Messrs, Thompson and Hatton's old Tin-plate Works-The Bilston Sheet Iron Company, belonging to Chambers and Sankey-W. G. Merriman's Lanesfield Works-John Bagnall and Sons-Ancient Bilston Trades-Fighting-cocks and Bull-dogs -Catchem's Corner and Hell Lane-Methodism in Bilston-The Rev. Mr. Lee and the Rev. dear J. B. Owen-Destruction of Vegetation-Constant canopy of smoke shrouds the district in a semi-London Fog-The sun powerless on the surface-Description of the Necropolis, with the flickering furnace-lights on the grave-stones by night-Fruitful source of contemplation for the denizens of its ghastly precincts and travellers-The public roads hollowed, being disembowelled by the Colliers-Bayliss, Jones, and Bayliss, the Contractors of London-F. N. Clark's and other great Works and Manufactories on the banks of the canal at Wolverhampton-Frederick Walton's highest class Papier Maché and Japan Manufactory-Perks's Edge Tool Works-Clark's Foundry-Bailey and Son's Chemical Laboratory-Thorneycrofts, and Isaac Jenks' Iron Works, and Bishton and Sons' extensive Galvanizing Works-Historical Reminiscences of this old town, which contains Loveridge's Japan and Tin Plate Works, the largest in England, and G. and W. Underhill's Iron stores, with perhaps the largest stock in England,

#### CHAPTER IX.

#### SHROPSHIRE IRON AND COAL DISTRICT.

Quite one of the oldest centres-Excellent Pig Iron made from Argilaceous Stone-Mr. John Horton and the Staffordshire worthies, who first used Shropshire Pig Iron-Coalbrookdale Company-Fame of this old Foundry—Their Furnaces and Iron Works—The Kettley Company and Mr. John Williams-The late Mr. William Botfield at Decker Hill and Malinslee-The Old Park and Sterchley -Sale of Sterchley-The Snedshill Iron Company-Snedshill Plates and Charcoal Rods very superior in quality-The Lilleshall Company-Their Nine Blast Furnaces-Their Phoenix Foundry-Engravings of all their Works-Full particulars at page [158]-Shropshire men seldom migrate-The Baldwins of Bilston and Stourport originally migrated from Shropshire-The towns in this 'Black Country'-The Madeley Wood Company and the Madeley Court-Madeley Churchyard the resting-place of the sainted Fletcher-Extraordinary Market at Oakengates on a Saturday night-Wellington and the Wrekin-Colley and Company's Screws and Boxes made in Staffordshire PAGE 98

#### CHAPTER X.

#### NORTH STAFFORDSHIRE.

Robert Heath and Sons, Kinnersleys, were Ironmasters and Bankers—Under Robert Heath's advice they bought the Clough Hall Estate, which was found to be full of minerals—Raise the coal at a great profit—The Bank advances very liberally to the Master Potters—China trade much encouraged by Kinnersleys' liberality—The late Robert Heath builds Iron-Works at Kidsgrove—The Bank is enriched by Coal and Iron-making—At the death of his father, the present Mr Heath

takes the management for Kinnersleys—Mr. Robert Heath commences business on his own account at Biddulph—An account of all Mr. Heath's extensive Works—See full particulars at page [147]—Mr. Heath the largest Ironmaster in Staffordshire—The great Shelton Bar Works belonging to Earl Granville—Mr. Roden, M.P., his Lordship's managing partner—Building of the Works regardless of cost—Shelton Bar a Model Works—Earl Granville's Blast Furnaces—Eight at Shelton—Frederick Wragge, Esq., his Lordship's sole agent and manager at the Blast Furnaces—Bars, Plates, and Angles at the Shelton Bar—His Lordship's extensive Coal Mines here PAGE 114

### CHAPTERS XI. AND XII.

THE MIDDLESBOROUGH, OR CLEVELAND DISTRICT.

The Quantity of Iron made—Increase in make for the last year given -Wonderful progress since 1854-Three Reasons for its great success -The Cleveland Iron Ore-Its extensive deposits in horizontal beds -The future Supply-The wages paid to Miners-The great advance in price-The Shift-work by the men-The appearance and quality of the Ore-Coal and Coke supply from Durham and Northumberland-Great activity of the district-Wages and the Conciliation Board-The Consett and Samuelsons, and a particular description of Bolckow and Vaughan's great Works and several other large concerns-Weardale Iron and Coal Company-Superior quality of their Iron-They make Spiegeleisen-Their Mines at Towlaw and Tudhoe-Weardale Iron and Coal Company make Bessemer Steel-Historical Sketch of Bolckow and Vaughan-Commencement of business-Leasing of the Eston Mines-Opening the Railway in three months-Wilton Park Works-Their make of Iron, &c., &c. . PAGE 119

## CHAPTER XIII.

#### NORTHAMPTONSHIRE.

#### CHAPTER XIV.

#### THE WHITEHAVEN DISTRICT.

#### CHAPTERS XV. AND XVI.

GLOUCESTER, FOREST OF DEAN, WILTSHIRE AND HAMPSHIRE.

Cinderford Iron Works—Gold Brothers at Soudley—The Wesbury
Companyin Wiltshire—The Seend Iron Works—The Messrs. Knights'
Ashton Vale Iron Works at Ashton Vale, Somersetshire, which
make good Iron—Remarkable history of Mr. Foley's Travels to
Russia, and Adventures in the Ural Mountains, page 139—Beautiful
Engraving of the Hyde Works—Beard and Eberhard's Regent Grove
Works, 145—Parkfield Furnaces, 147—The Horsleyfields Chemical
Works—Account of Mr. William Bailey's Discoveries in Chemistry
—Blake's Stone Breakers

## CHAPTER XVII.

#### NORTH AND SOUTH WALES.

#### CHAPTERS XVIII. AND XIX.

#### SCOTLAND.

Shipbuilding yards on the Clyde—Jute Mills at Aberdeen and Dundee—Paisley shawls—The Carron Foundry—Great success of Scotchmen in everything they undertake—Superiority of Scotch

Foundry Pig Iron—Reasons why—Falling-off in the make—Serious matter—Reason why—High price of Scotch Pigs—Mineral wealth of the Shotts Iron Company—Will the supply of Coal keep up?—Malleable Iron Manufactories—Mossend Iron Company at Hollytown, and the Blochain Company, Glasgow, belonging to Robert Hannay and Sons—Bessemer Steel Converting—Early History of the Carron Foundry, and the Malleable Iron Trade in Scotland

#### CHAPTER XX.

#### SCOTCH IRON WARRANTS.

What is a Warrant?—This question answered—History of Warrants—Causes which brought them into existence explained — Makers engagements—Connals the public storekeepers—Simple mode of transfer—Convertibility of a Warrant into metal—Connal's charges for unloading, stacking, shipping, and rent—Rival stores—All opposition to Connals' stores unsuccessful—Connals' are the only stocks now available.

PAGE 169

#### CHAPTER XXI.

### SPIEGELEISEN, ITS USE AND MANUFACTURE.

Indispensable for Bessemer Steel Making-Made principally in Sweden and in the neighbourhood of Siegen, in Prussia-The very best quality of Spiegeleisen is likewise made by the Weardale Company at Towlaw from their Spathic Carbonates-The quality of the Weardale article best in the market-The Ebbw Vale Company make Spiegeleisen-Process of manufacture-Cost ditto-Hayward, Tyler and Co,'s Works-Foundries and Fitting Shops in Whitecross Street, London, and Luton, Beds. page [143], with a description of their Universal Steam Pump-Carpenter and Tildesley's Lock Manufacturies, Summerford Works, Willenhall, page [146]-Largest Iron Works in Staffordshire, page [147], with minute particulars—Some History and Particulars of the Bowling Iron Companies at Bradford, page [149]—Particulars and Statistics of the Lilleshall Company's Phoenix Foundry and Great Iron Works, in Shropshire, page [158] -Quantity of Iron made, &c., at Lilleshall (9 Blast furnaces) page [159]—Important Hints and Information for Iron Masters and Iron Merchants, page [160]-Sketches of Noted Iron Works and Iron Master, pages [161-165]-Correct particulars of the Darlaston Steel and Iron Company, page [161]—David Rose's Albert and Moxley Iron Works, with the Galvanizing Works, Furnaces, Collieries, and Sandbeds, page [163]—History of Puddling, beginning with Henry Cort, pages [165 to 172]—The Bilston Iron Company, with a description of all their Works, page [172], with Engraving of Works.

#### CHAPTER XXII.

#### PIG IRON MANUFACTURED IN 1871.

Total quantity of Iron Ore raised in the United Kingdom-Foreign Ores Imported-Ditto Calcined-Total quantity Smelted in the United Kingdom-Value of the same-Number of Furnaces in Blast in 1871—Quantity of Pig Iron produced in England—Ditto Wales-Ditto Scotland-Total production of Pig Iron in Great Britain-Total Market Value of Pig Iron produced in Great Britain -Summary of producing districts-Northumberland-Number of Works-Furnaces in Blast-Quantity of Iron made-Durham, ditto, ditto, ditto-Yorkshire, North Riding, the same-Yorkshire, West Riding, the same-Derbyshire, the same-Lancashire, the same-Cumberland, the same-Shropshire, the same-North Staffordshire, the same-South Staffordshire, the same-Northamptonshire, the same-Lincolnshire, the same-Gloucestershire, the same - Wiltshire, the same - Somersetshire, the same -The same synopsis with regard to North Wales-The same synopsis of Glamorganshire, Brecknockshire, and Monmouthshire, and the same for all the Iron Counties in Scotland, with the total make of Iron in the United Kingdom-Quantities, with the Market Value for 1871, of all the Coal and Iron raised in the United Kingdom-Ditto, ditto, Copper Ore-Tin Ore-Zinc Ore-Lead Ore-Pyrites-Silver Ore-Arsenic-Gossans-Nickel-Wolfram-Bismuth-Flour Spar-Cobalt Ore-Barites-Fire Clays and other Clays-Earthy Minerals-Salt-Coprolites-With separate and total money value of the whole for 1871-A Synopsis Table showing at one view Value and Quantities of each Metal manufactured in the United Kingdom, including all earths and minerals—The quantity and Market Value of Iron Ore raised in Cornwall-The same with regard to Devonshire-Somersetshire-Gloucestershire-Wiltshire-Oxfordshire - Northamptonshire - Lincolnshire - Shropshire - Warwickshire-North Staffordshire-South Staffordshire-Derbyshire-Lancashire - Cumberland - Yorkshire, North Riding-Yorkshire, West Riding-Northumberland and Durham-North Wales-South Wales and Monmouthshire—Isle of Man—Scotland—Ireland—With the totals exhibited . **PAGE 177** 

# CHAPTER XXIII.

### COAL RAISED IN THE UNITED KINGDOM.

Gross Output for 1872—Output for 1871—Money value of the same— Money value of Output of 1872—Great importance of Coal—Output in value of Tin, Copper, Lead, and Silver, in this country altogether, compared with Coal-Increasing export of Coal-Vital importance to national prosperity-Ministration of Coal to all manufactures - Quantity raised in Lancashire - Cheshire - Yorkshire -With number of Collieries-Cheshire, with number of Collieries-Yorkshire, with ditto-Northumberland and Durham, with number of Collieries-How and where the produce of 29,000,000 of tons was disposed of-The same, Cumberland-The same, Derbyshire-Nottinghamshire - Leicestershire and Warwickshire - Monmouthshire, Brecknockshire, and the edge of Glamorganshire, Gloucestershire, Somersetshire, North and South Wales-Forest of Dean-Staffordshire and Worcestershire - Shropshire and Scotland-Government Inspectors-Names and Addresses of all the Collieries -Summary of Coal produce in the United Kingdom, mentioning all the Counties in which Coal is raised-The quantity raised in each County, with the total for the United Kingdom-Great Export demand for 1872—Falling off in Scotch production—Observations on our Coal Fields-Valuable statistics in regard to Coal-Number of Collieries in each Inspector's district, with the name of the Government Inspector-The countries abroad who buy our Coal -The quantity they each take every year-Its Market Value

**PAGE 182** 

# CHAPTER XXIV.

### SHIPBUILDING YARDS ON THE BANKS OF THE CLYDE.

The noble Clyde lashing the banks of Connal's Stores—The Shipbuilding Yards on the banks of this splendid river—The largest, most numerous, and extensive in the United Kingdom—Iron Steamers built for all Nations—Unrivalled skill of Scotch Engineers—The Names of the great Engineers introduced—Economy in the generation and application of Steam by John Elder & Co.—Gigantic power of Engines built on the Clyde—Honour to Elder—Laird—Napiers—Dennys—Thompson and Rankine—Noble Gift by John Elder for educating aspirants to fame in Iron Naval Architecture

### CHAPTER XXV.

### NEW TRADE OF STEEL CASTING.

### CHAPTER XXVI.

### WILLENHALL AND ITS LOCKS AND BOLTS.

Willenhall the seat of Lock and Bolt Trade for the World—Topography—Number of Inhabitants—Number of Manufactories—All the Articles they make at Willenhall—Blaspheming, drunken Parson forty years since—Statistics of Chapels and Churches—The Albion Works of Harper & Co.—Carpenter and Tildesley's great Lock Manufactory—James Tildesley, the proprietor, being the son-in-law of the late Mr. Carpenter, the founder of the firm of Carpenter and Tildesley—Also see page [146] for description of Summerford Works

# CHAPTER XXVII.

# THOMAS PERRY AND SONS' GREAT ENGINE-SHOP AND FOUNDRY. AT BILSTON.

Make Steam Engines—Chilled Rolls—Mills with Reversing Gear—Three High Mills and all Modern Machinery for Iron Works—Albion Iron Works, Westbrownich—Erected by Walter Williams, Esq.—Albion Sheet Iron Company—Trident Sheets made here—Britannia Iron Company—All kinds of best Iron, particularly Fancy Iron—Tangye Brothers and Holman's Direct Acting Steam Pumping Engine, p. 211—Saving of Expense—Great Revolution—The Carron Company's Water Engine; in 1792 one of the wonders of Scotland—Cornish Engines—Great cost of same—Mr. A. S. Cameron's (of New York) Invention—Engraving of Tangye's Horizontal Engine—Engraving of Tangye Brothers and Holman's Direct Acting Steam Pumping Engine—Great Economy and other advantages—A Description of Tangye Brothers and Holman's great Cornwall Works at Birmingham

Messrs. George Adams and Son; Messrs. J. P. and W. Baldwin; the Albion Sheet Iron Company; Messrs. Lee and Bolton; Messrs. William Millington and Company; the District Iron and Steel Company; the Snedshill Iron Company; Messrs. W. Barrows and Sons; Messrs. William and Thomas Whitwell, Thornaby Works; the Darlaston Steel and Iron Company; the Britannia Iron Company; Mr. John Marshall; Mr. Henry Hall, Brierley Hill Old Level Works; Messrs. N. Hingley and Sons; Messrs. Gold Brothers, Sudelev Furnaces: Pontnewynyod Iron Works: Messrs. W. Dawes and Sons; the Ashton Vale Iron Company; Messrs. Gyers, Mills and Company; Messrs, Appleby and Company; the Chillington Iron Company; the Tredegar Iron Company; Messrs. Fletcher, Solly and Company; Messrs. Lloyds and Company; the Bilston Brook Furnaces; Messrs. M. S. Goddard and Sons; Messrs. Round; Messrs. Roberts and Company; Messrs. Watson, Kepling and Company; the North of England Iron and Coal Company, Limited; Messrs. Thomas Webb and Sons; Messrs. Swan, Coates and Company; the Wingeworth Iron Company; Lumphinnans; the Frodington Works; the Weardale Iron Company; Messrs. Molineux; Messrs. Fowler and Company; Messrs. Hugh Martin and Sons; the Brymbo Iron Company; the Norton Iron Company, Limited; Mr. Robert Crawshay; Mr. John Spencer.

The Earl of Dudley's Works; W. Barrows and Sons' various Works; Messrs. John Bagnall and Sons'; the Earl Granville's; the Lilleshall Company; the Shelton Bar Iron Company; the Barrow Steel Company; Messrs. Bolckow and Vaughan; Messrs. Robert Heath and Sons; the Patent Nut and Bolt Company; Cwm Bran Works; the Coalbrookdale Company; the Madeley Wood Company and the Madeley Court Furnaces; the Bradeley Bridge Charcoal Furnaces; Henry Mills; Victoria Works; Isaac Jenks and Sons'; Mayor of Wolverhampton's Steel Works; Messrs. Beard and Eberhard, Regent Works; Merriman's Lanesfield Works; Messrs. Philip Williams and Sons; the Consett Company, and other eminent makers, the reader will find specially noticed in the body of the work.

		CC	)NTE	NTS.					2	xxi	
										PAGE	
A correct l	List of all the	Iron I	ferch	ants i	in Lo	ndor	1.			223	
All the Sh	ippers of Iron	in Lo	ndon							223	
All the Ex	port Merchan	its of (	Coal in	Lor	don					223	
Ditto	ditto	of I	Iardw	are (	oods	in I	ondo	on .		223	
Ditto	ditto	of M	<b>I</b> achin	nery	in Lo	ndor	ı .			223	
Ditto	ditto	of C	opper	in L	ondo	n.				223	
Ditto	ditto	of T	in							223	
Ditto	ditto	of I	ead							223	
Ditto	ditto	of S	pelter	٠.						223	
Ditto	ditto	of F	ullior	1.	Read	ers	of	this	list		
should r	efer to 'Hint	to Me	rchan	ts,' a	t pag	e [16	30]			223	
LIST of all	the BLAST F	URNACI	s in t	he U	NITEI	K	NGDO	M, she	ow-		
	ow in Blast a										
of the w	orks, their pr	oprieto	rs, an	d pro	per a	ddre	sses,	toget	her		
with the	kind and qua	lity of	the l	ron i	nade	at e	ach			253	
Synopsis o	f Blast Furna	ces in t	he U	NITE	KIN	GDO	м.			267	
All the Ch	narcoal Furna	ces in	Engla	ind a	nd S	cotla	and,	with	the		
names a	nd addresses	of the p	ropri	etors						267	
LIST OF A	LL THE PUDD	LING H	URNA	CES	IN TE	E U	NITE	D KI	NG-		
DOM										268	
General S	ynopsis of all	the I	uddli	ng F	urna	ces i	n th	e Uni	ted		
Kingdon										281	
List of Sm	elters and Me	tal Ex	tracti	on Co	mpai	nies	in th	e Uni	ted		
	n (Lead) .									282	
List of all	the Zinc Sme	ters								283	
	mpanies .									284	
Arsenic	,, .									284	
A list of ni	ineteen of the	best I	Iæma	tite I	lines	in V	Vest	Cumb	er-		
	he Reader w										
an accou	nt of them									285	
A list of th	ne Bessemer S	Steel W	orks	in the	Uni	ted :	King	dom		286	
A list of al	l the Tin Plat	e Manu	factu	rers i	n the	Uni	ted I	Cingd	om	286	
A correct	account of th	ne high	est, t	he lo	west	, and	l the	avera	age		
price of	Bar Iron at Li	verpoo	l in ea	ich y	ear, c	onse	cutiv	ely fr	om		
1806 to 1	1873									288	
Compendiu	m of Mechan	ics								290	
	nd Measures									290	
Imperial S	tandard Weig	hts and	Meas	sures						290	
Standard V										290	

								PAGE
Standard Pound								290
Standard Gallon								290
Standard for Heape	d M	easure						290
Measures of Length								291
Various French Me	asur	es .						291
Measures of Surface	, or	Squar	е Ме	asure				291
Measures of Solidity	y, or	Cubic	Me	sure				291
Measures of Capacit	ty.							292
Measures of Weight							٠.	292
Troy, Avoirdupois								292
Lineal Measures for	La	nd .						292
Square Measures fo	r La	nd						293
Nautical Measures						,		293
Various Special Me	asur	es .						293
Weight of Water								294

# METALS IN CONNEXION WITH THE ARTS, CIVILISATION, AND SOCIAL PROGRESS:—

Gold Zine
Silver Lead
Copper Quicksilver
Tin Cobalt
Antimony Iron

Iron as a Medicine All the Preparations

Chemicals and Tinctures of the Pharmacopœia made from Iron,
adopting the nomenclature of the British Pharmacopœia

PAGES 294-297

A general Table of all the Metals, with Author's remarks thereon, giving chemical equivalents, when and by whom discovered, specific gravity, and their medicinal properties, with commercial use, origin, short history, and general properties . PAGES 298-305

# The Table embraces the following Metals:-

Gold	Glucinum	Potassium
Silver	Yttrium	Sodium
Iron	Thorium	Barium
Copper	Magnesium	Strontium
Mercury	Vanadium	Calcium
Lead	Lanthanum	Cadmium
Tin	Bismuth	Lithium
Antimony	Zinc	Silicium
Uranium	Arsenic	Didymium
Titanium	Cobalt	Erbium
Chromium	Platinum	Terbium
Collumbium or	Nickel	Ruthenium
Tantalum	Manganese	Pellopium
Palladium	Tungsten	Niobium
Rhodium	Tellurium	Illemium
Iridium	Molybdenum	Norium
Zirconium	Osmium	4
Aluminum	Cerium	•

Preparations and Compounds in Pharmacy and Chemistry made	
from Quicksilver, Bismuth, and Zinc, and acknowledged in	
the Pharmacopœia	306
STRENGTH OF MATERIALS	-312
Statistics of Scotch Pig Iron from 1740 to 1827—Ditto from 1827	
to 1857	313
Synopsis of Produce of Pig Iron in England in 1825 and 1854-	
Mr. Kenyon Blackwell's paper on the Quantity of Iron made,	
read before the Society of Arts in 1854, on the Iron Industry	
of Great Britain	314
English Blast Furnaces and Rolling Mills existing North of the	
Humber published in Griffiths' 'Iron Trade Circular,' March	
1856, see Griffiths' Statistics published in a detached form on	
this subject in January 1861	315



# LIST

OF

# ENGRAVINGS AND ILLUSTRATIONS.

Earl Granville's Shelton Furnaces	and C	ollier	ies, S	taffo	rd-		
shire					Free	mtis	picce
							PAGE
View of the Barrow Steel Works					•		30
Earl Dudley's Coal Field					faces	p.	4.5
Getting Coal at one of Earl Dudle	y's Th	ick C	oal P	its	,,		47
Underground Work at Earl Dudle	y's Sa	lt We	lls Co	llier	y, wh	ere	
the Thick Coal is obtained .					faces	p.	49
The Birmingham Exchange .					,,		52
A Pair of the Earl of Dudley's	Thick	Coal	Pits	in t	he Bla	ick	
Country							58
Earl of Dudley's Round Oak Iron	Work	s.					60
W. Barrows and Sons' Bloomfield	Iron '	Works	, Tip	ton,	Staffor	rd-	
shire					faces	p.	63
W. Barrows and Sons' Tipton Gree	en Iro	n Wo	rks				64
W. Barrows an Sons' Factory Wor	ks, Ti	pton					65
Minerva Iron and Steel Works .							68
Beaver Iron, Steel, and Spring Wo	orks						69
George Adams and Son, New Price	stfields	Iron	work	3		٠.	76
Edward Davies's Crown Galvanizin	g Wo	rks					92

# XXXVI LIST OF ENGRAVINGS AND ILLUSTRATIONS.

The Lilleshall Co.'s Great Foundry and Engine Factory ,, 103 The Lilleshall Co.'s Lodge Furnaces in Shropshire ,, 104 Prior's Lee Furnaces, belonging to the Lilleshall Company . 115 One of Robert Heath and Sons' Iron Works at Norton le Moor, Staffordshire	Neptune Forge, Chain and Anchor Works, Tipton . fo	ices p.	PAGE 97
The Lilleshall Co.'s Lodge Furnaces in Shropshire ,, 106 Prior's Lee Furnaces, belonging to the Lilleshall Company . 112 One of Robert Heath and Sons' Iron Works at Norton le Moor, Staffordshire		•	
Prior's Lee Furnaces, belonging to the Lilleshall Company One of Robert Heath and Sons' Iron Works at Norton le Moor, Staffordshire	The Lilleghall Co's Ladge Furnages in Shronghine		
One of Robert Heath and Sons' Iron Works at Norton le Moor, Staffordshire	•		
Staffordshire			
Earl Granville's Etruria Furnaces, Staffordshire ,, 117 A Pair of Earl Granville's Model Coal Pits			112
A Pair of Earl Granville's Model Coal Pits	Faul Granville's Etminis Furnaces Staffordshine	•	
Shelton Bar Iron Company's Etruria Mills, Staffordshire ,, 118 Shelton Bar Iron Company's Works and Mills , 118 Port of Whitehaven	A Dain of Farl Granville's Model Coal Dita		
Shelton Bar Iron Company's Works and Mills	Shelton Pan Iron Company's Etminia Milla Staffondahina		
Port of Whitehaven	Shelton Ban Iron Company's Works and Mills		
Collegiate Old Church, St. Bees			
St. Bees			
The Park Field Furnaces, Park Fields, Wolverhampton ,, 135 Approved Plan for Modern Blast Furnaces ,, 136 Lee and Bolton's Hyde Iron Works, Worcestershire ,, 138 George Beard and B. H. Eberhard, Eyre Street Sheet Iron Mills, Birmingham			
Approved Plan for Modern Blast Furnaces			
Lee and Bolton's Hyde Iron Works, Worcestershire ,, 138 George Beard and B. H. Eberhard, Eyre Street Sheet Iron Mills, Birmingham			
George Beard and B. H. Eberhard, Eyre Street Sheet Iron Mills, Birmingham	••	•	
Mills, Birmingham	· · · · · · · · · · · · · · · · · · ·		100
Regent Grove Iron Works, Cape, Birmingham			144
W. Millington and Company's Summerhill Iron Works and Rolling Mills, Tipton, Staffordshire	,		
Rolling Mills, Tipton, Staffordshire		s and	
Horseley Fields Chemical Works, Wolverhampton			147
Blake's Stone Breaker (fixed machine)		acco p.	
Blake's Stone Breaker (to travel)			
The Glasgow Exchange			
The Darlaston Steel and Iron Company			
The Darlaston Steel and Iron Company's Blast Furnaces and Iron Foundries		aces n	
Iron Foundries	· · · · · · · · · · · · · · · · · · ·	-	[IOI]
One of the Darlaston Steel and Iron Company's Blast Furnaces at Darlaston			[161]
at Darlaston		-	[101]
One of the Bilston Iron Company's Works, Stone Field ,, [172] The Bilston Iron Company's Stonefield Iron Works [174] Britannia Iron Company's Albion Works, Westbromwich			[162]
The Bilston Iron Company's Stonefield Iron Works [174] Britannia Iron Company's Albion Works, Westbromwich		_	
Britannia Iron Company's Albion Works, Westbromwich . 210 Tangye Brothers and Holman's Direct-Acting Steam Pumping			
Tangye Brothers and Holman's Direct-Acting Steam Pumping			
	• • •		
cu6mes	engines		, 213

# INDEX TO ADVERTISEMENTS.

			LAGI
McNiel, Muller and Co			. [i]
The Wellington Coal and Iron Compan	ıy		. [ii]
Messrs. Isaac Jenks and Sons			. i, xl, xli
Messrs. James Russell and Sons, Limit	ted		. ii, iii
Messrs. Andrew M'Laren and Co			. iv, v
The Britannia Iron Works			. vi
The Birchills Hall Company			. vii, xcvi
Mr. Benjamin Gibbons			. viii
Messrs. E. P. and W. Baldwin			. ix
Messrs. Colley and Co			. x-xiii
Mr. W. T. Holland			. xiv
Messrs. Claridge and North			. xv
Messrs. Lee and Bolton			. xvi
Messrs Tangye, Brothers, and Holman			. [xiii]-[xvi]
Messrs. Wadham, Sen., and Co			. xvii
Barrow Hæmatite Steel Company .			. xviii-xx
Mr. J. F. Lloyd			. xxi
Bradley Bridge Charcoal Company .			. xxi
Messrs. John Harper and Company .			. xxii-xxv
Messrs. Lander and Larsson			. xxvi
Messrs. Bailey			. xxvii-xxix
Mr. Stanley			. xxx
Messrs. Beard and Eberhard			. xxxi
Mr. S. Lewin			. xxxii-xxxvii
The Lilleshall Company			. xxxviii, xxxix
Messrs. Moore and Manby			. xlii, xliii
Messrs. Hadfield			. xliv-xlvi
Mr. Edward Davies			. xlvii-xlix
Messrs, Robert Heath and Son			· l_liv

# XXXVIII INDEX TO ADVERTISEMENTS.

				PAGE
The Snedshill Company .				lv
Mr. H. R. Marsden '				lvi, lvii
The Earl of Dudley				lviii-lx
Messrs. Roberts				lxi
Messrs. Charles Ryland and Son	ı			lxii, xliii
The Bowling Iron Company				lxiv-lxvi
The Darlaston Steel Company				lxvii-lxx
Joseph Gillott				lxxi
Mr. John Horsley				lxxi
Messrs. W. Barrows				lxxii-lxxv
Messrs. J. Bagnall				lxxvi-lxxix
The Cheque Bank				lxxx, lxxxi
Messrs. Rylands, Brothers				lxxxii, lxxxiii
Messrs. W. G. Merriman .				lxxxiv, lxxxv
Consett Iron Company .				lxxxvi-cix
Messrs. Guest				lxxxvii
Messrs. Hayward, Tyler, and C	ompa	ny		lxxxviii-xci
Patent Nut and Bolt Company				xcii-xcv
Messrs. Strathern and Company				xcvi
Mr. E. Dent				xcvi
Messrs. Hill and Smith .				xevii
Mr. J. Elwell				xeviii, xeix
Messrs. W. Millington and Con	pany			c
Messrs. Nicklin				ci
Messrs. J. and E. Wright .				cii
Mr. Joseph Pearson				ciii
Mr. William Rose				civ
Messrs. Swinden				cv
Mr. Samuel Dickinson .				cvi
Mr. Joseph Baker			.′	cvii
Messrs. Barrows and Stewart				eviii
Messrs. Underhill				cx, cxi
Messrs. Bailey, Toms, and Com	pany			cxii
Staffordshire Iron Works .				exiii
John Dawes and Son				exiv, exv
S. Griffiths and Company .				cxvi, cxvii
Chillington Company .				exviii, exix
Mr. David Rose				exx, exxi
Bradley Bridge Company .				exxii

# Earl Granville Cxxiii W. Bird and Co. cxxiv Iron Trade Exchange cxxv District Iron Company cxxvi Mr. Jeremiah Dimmack cxxvii Mr. F. Lloyd cxxviii

INDEX TO ADVERTISEMENTS.

XXXX

### ERRATA.

Page 35, line 10, for soon after, read long before. Page 106, line 20, for the beginning, read page 105. Page 106, line 27, for oil, read mine and ore. Page 111, line 12, after the word puddling, add and. Page 116, for anchors, read hoops, in footnote. Page 139, line 25, for Sagitarius, read Straduarius. Page 143, for Padwick, read Paddock, in footnote. Page [163], lines 16 and 17 inserted in error. Page [173], line 5, for Satten read Latten.

# GRIFFITH'S ANNUAL REVIEW

OF

# THE IRON TRADE FOR 1872.

133 CANNON STREET, LONDON.

# CHAPTER I.

In the future annals of the Iron Trade of Great Britain, the year 1872 will always be referred to as the most remarkable on record, not only because of the great expansion of all metallurgical trades and manufactures, but more especially on account of the greatly increased value of Iron which was established in Great Britain in the middle of the year under review. The market price at the time above referred to reached £16 per ton for bars, B.B.H. brand, which was firmly adopted in the fixed rate lists of all the leading Staffordshire manufacturers. This extraordinary revolution in prices will exhibit itself in more striking contrast if wé remember that during the year 1870 the official price of bars, £8 per ton, remained unchanged over the The price whole year: the most important metal produced has of iron doubled. therefore increased in value since July, 1871, from £8 to £16 per ton, certainly the most marvellous 'jump' during the space of eighteen months in the value

of Iron or any other metal, to our knowledge, on record.

Staffordshire bars sold at £16 10s. in Liverpool. Make of Pig Iron in 1807. It is true that in 1806,¹ and especially in 1807, prices of Iron ruled higher than in 1872; but during those years the make was infinitesimal compared with the enormous output of 1872; at this period, Sweden and Russia were the prominent Iron producing countries of the world; now Great Britain produces more Iron than all the world besides, and rules the Iron markets on every Exchange in Europe.

With the above exceptions, never in this century have prices been so high, the exportation and consumption so large, or the general diminution in stocks so marvellously rapid.

The make of Iron for the United Kingdom for 1872, we estimate, after a careful consideration of the whole subject, at 7,250,000 tons. According to Mr. Robert Hunt's valuable statistics, which cannot be too highly commended, the make of 1871 was 6,627,179 tons, which leaves an increase in produce of 522,821 tons over 1872. The value of this 7,250,000 tons, at the present market price, is about £50,000,000 sterling, taking the mean average price of all makes at £7 5s. per ton, which will be under the mark, if the higher values of the contributions to the great aggregate, furnished by Whitehaven in Cumberland, Barrow-in-Furness, and the valuable produce of the West Riding of Yorkshire, Shropshire, and Staffordshire, are taken into consideration. In producing <sup>2</sup> 7,250,000 tons of pig Iron, at

Gross money value.

<sup>&</sup>lt;sup>1</sup> See Appendix, Table, page 181.

<sup>&</sup>lt;sup>2</sup> The conclusions we are aware are open to comment, and some good

least 1 25,000,000 tons of coal, dross, and slack have been consumed, and in foundry, steam engine boilers, puddling, mill-furnace, Bessemer converting, and other processes incidental to the manufacture of Iron, before it is finished into a bar, hoop, sheet, or wire rod, a further consumption of at least 20,000,000 tons must have been absorbed during the year under review. The output of coal for last year we estimate Total outat 125,000,000 of tons, 1871 was 117,352,028 tons. put of coal Besides the above large amount of coal consumed in Iron making, the consumption in Iron manufactures, say, nuts, bolts, wrought nails, frying pans, firearms, and other Birmingham wares; the Sheffield, Wolverhampton, Dudley, West Bromwich, and Darlaston hardware goods, with the great edge tool works, engineering and foundry establishments throughout Great Britain, we estimate have consumed another 15,000,000 tons of coal. If we say 25,000,000 for pig Iron, 20,000,000 for the manufacture of malleable Iron and Steel, and 15,000,000 of Gross tons for iron manufactures of all kinds, this gives a quantity total absorption of coal in the Iron trade, for 1872, of Iron and no less than 60,000,000<sup>2</sup> of tons, which, taken from the trades relating

thereto.

authorities may hesitate to sanction our rate of consumption, we have the greatest respect for Mr. Bell's opinion, no doubt the highest living authority, and certainly the most practical. The indisputable facts contained in the returns furnished to us by the Scotch, Shropshire and Welsh Ironmasters bring us under the convictions represented in the above figures.

We are aware that we make the consumption much greater than some other greatly esteemed very high authorities, but think careful investigation on the subject will sustain our figures.

<sup>2</sup> See the quantity of coal raised in every county in Appendix tables, page 182.

output above referred to, is about half the whole

quantity raised out of the crust of the earth. we bear in mind the scarcity of coal on the Continent, and the consequent greatly increased demand upon us for this mineral from abroad, the above startling figures will explain the increased demand for this article in our domestic market, and the enormously advanced price established for coal in all parts of the world during 1872. Much has been said and written on this subject respecting combinations and conspiracies among the coalowners, to raise and keep up the price: these figures, however, may perhaps enable even most inexperienced in these matters to perceive, that the present price of coal has been brought about by increased demand, which must be placed more to the account of the augmented consumption of this article in Iron making, than any other absorbing element either at home or abroad. We have in the United Kingdom, 916 blast furnaces erected, the principal districts being Cleveland, including North, East, and West of England, 290 furnaces, South Wales, 188; Staffordshire, 207; Scotland, 154; total in all districts, 916. Of these, 696 were in blast, or, in other words, at work producing Iron.

Price of Coal raised by the demand in the Iren trade.

In 1861, the number of furnaces in blast were: 1565. We arrive at the above conclusions with regard to the produce of 1872 by careful observation and analysis of returns of the various districts. First, Scotland shows a falling off, to a considerable amount, in yield; this, however, will prove almost a solitary case.

1 See "Griffith's Statistics" for that year.

Notwithstanding the difficulties experienced in South Staffordshire from want of coal, the works, with the exception of about five or six weeks, were actively employed all the year, consequently no diminution in the produce is expected. The same may be said with regard to Shropshire and South Wales. We know that an increase of 84,733 tons has taken place in the Cleveland district, and if we give credit in the general estimate for the great activity in the Whitehaven, West Cumberland, Barrow-in-Furness, and other districts in Lancashire, Yorkshire, Derbyshire, and not forgetting the progressive condition of North Staffordshire and Northamptonshire, we think our friends in the trade will agree with us, that the estimate we have made cannot be far wrong.

We have exported Iron and Steel of all kinds, last year, 3,388,622 tons; we exported in 1871, 3,169,219 tons, which gives seven per cent. in quantity in favour of last year. The value of the later year's export was £36,060,547, the value of exports for 1871 was £26,124,134, so that the value of the Iron exported from the United Kingdom in 1872, shows an increase of thirty-five per cent. over that of 1871.

If we for a moment consider the innumerably great trades and interests in which Iron forms the chief staple, such as steam engines, all kinds of machinery, railway appliances, the cutlery of Sheffield, the locks, trays, and cut nails of Birmingham and Wolverhampton; the wrought nails, chains and anchors, nuts and bolts, made in the neighbourhood of Dudley, and thousands of other swarming hives of metallic indus-

tries in the Black Country; not forgetting the great Iron shipbuilding yards on the banks of the Clyde, the Tees, the Mersey, and elsewhere, the monster shops and works at Sheffield and other centres in Yorkshire—it requires no stretch of imagination to arrive at a truthful conclusion, that the wages paid to forge men, mill men, furnace men, colliers, miners, and the various handicraft men in Iron, far exceeds the revenue of the country, and in a fiscal and social point of view, contributes more to the wealth, progress, and prosperity of this highly-favoured land than any other industry of which England has reason to be proud.

The figures given below refer exclusively to the quantities and value of pig Iron made in 1872. We must now endeavour to show what quantity of this great aggregate was exported to Foreign Countries, and then deal with the balance, showing to the best of our ability how it was disposed of. In order to arrive at the balance, let us see what the total stock of 1872 really was: we think it will be found about as follows:—

	Tons.
Make of Iron in 1872	7,250,000
Out of Stock in Scotland	296,000
Out of Public Stocks in Middlesboro'	1,800
Out of Ironmasters' Stocks in Middlesboro' .	25,000
Out of Makers and Forge Masters' Stocks	,
in Staffordshire, Shropshire, South Wales,	
Lancashire, Yorkshire, Cumberland,	
Northamptonshire, Gloucestershire, and	
Durham	300,000
Old Iron and Scraps, Remanufactured, including	,
old Cast Iron Re-melted	100,000
	7,972,800

Of this quantity, which is the positive stock of pig Iron upon which we have been working, 1,332,726 tons have been exported abroad, and the balance has Exact been made into manufactured Iron, or smelted down at Pig Iron the innumerable large and small foundries and engine shops of the United Kingdom. The next question which presents itself is, How has it been disposed of? The Board of Trade returns show clearly that 3,388,622 tons of Iron and Steel of all kinds have been exported. Of this quantity, 1,332,726 was pig Iron, upwards ported. of 660,000 tons to Germany and Holland, 90,200 tons to France, 193,957 to the United States, and 385,687 tons to other countries. The balance, of the 7,972,800, after deducting the export of pig Iron, will be 6,640,074; the balance, therefore, of pig Iron left in England will be, as above, 6,640,074—a very large amount indeed—as the surplus of our make, after supplying the foreign demand for pig Iron by export.

exported.

Gross quantity of iron and steel ex-

Our next object will be to show how this large balance was disposed of, and mention the various home manufactures and trades which imperatively require it, having, in fact, absorbed and literally melted it away at a considerable profit to the nation. The great home consuming element is of a fourfold character :\_\_\_

I. Malleable Iron and Bessemer Steel, the making Gross of which has consumed no less than 4,870,074 tons.

II. Tin plates, being in truth Iron plated with Tin. III. The foundries in all parts of the United Kingdom probably absorbed 1,770,000 tons.

quantity used up at the works and the foundries.

IV. The thousands of manufactures into which Iron enters consumed the balance of malleable Iron made out of the above large aggregate of pig, minus the quantity exported in malleable Iron, Steel, and Tin Plates. The quantity of Tin Plates exported was 2,364,684 cwts.

The mills and forges with their 6,841 puddling furnaces and the fifteen Bessemer Steel works with their seventy-eight converters, have, without doubt, made the largest demand upon the stocks, as will be seen by the figures above.

The malleable Iron made at the rolling mills, including the quantity exported before referred to<sup>1</sup>, has all been exported or used up for home consumption.

Black plate for tin plates. A very large portion has been consumed in rolling the black plate for Tin Plates. We shipped in 1872 2,364,684 cwts. of Tin Plate, and no doubt consumed in this country three times this quantity. It is impossible to say with precision what quantity of our stock of 1872 was melted by the Iron founders.

In Scotland, however, it is correctly ascertained that the Iron founders consumed 270,000 tons of pig Iron. What quantity has been consumed by the Iron founders in England and Wales we cannot correctly state; we can affirm it to be very large, perhaps, 1,500,000 tons, which, with Scotland, would absorb in all for foundry purposes 1,770,000 tons, which being added to the 1,322,726 tons exported, gives a total of 3,102,726 tons for export and home foundries, leaves a balance

1,845,351.

for manufacture, out of the gross stock which has been consumed in the Bessemer Pots and puddling furnaces, of 4,870,074 tons.

In the fourth place we come to the most interesting part of the home consumption question, for although element No. 1 consumes by far the largest portion of the pigs, element No. 4 re-consumes and works up the malleable Iron and Tin Plates produced, and fashioning them into implements and weapons of war, articles for culinary and other domestic purposes, and a thousand other tools and articles for the use of man in all parts of the world. Indeed, it is after all, our great manufactures in Iron, Steel, and hardware goods which Shipped to North pre-eminently in a commercial point of view places this America country above all others. A plating bar, B.B.H., which and the Brazils. costs £18 per ton, is made into a beautiful bright axe and sold from £65 to £70 per ton, and the same principle applies sometimes in a greater, often in a lesser, degree to all articles manufactured from malleable Iron, which is the base of Steel; all the knives, saws, and other carpenters' tools of Sheffield, and the cut nails, japannery, and steel pens of Birmingham, the locks of Willenhall, and the saddlers' ironmongery of Walsall, the forged nails of Sedgley, Gornal, Dudley, and the Lie Waste, and the massive cables and anchors of Tipton and Westbromwich, are produced from this article; but there are other large consuming works, among which must be mentioned the great galvanizers of Wolverhampton and Birmingham. This has become

B.B.H. is the brand of W. Barrows & Sons of the Bloomfield Works, the best makers of plating iron in England.

a very large trade, which consumes more sheet Iron than any other metallurgic industry in England.

The cut nail makers of Birmingham and Wolverhampton are likewise large consumers of sheet Iron. Besides all these consumptive elements we have our home railways, which are always wanting and continually buying rails, bars, and use Iron, with castings for turntables and signal stands, rails and chairs; the best malleable Iron for their fitting shops, Iron for their bridges, Iron for their stations, Iron for their engines, their wheels and axles, in fact Iron for everything. A very large demand is likewise made upon the wire mills of Shropshire and elsewhere for wire rods for the telegraphs and agricultural fencing in all parts of England and the Continent; and lastly, the Iron ship building yards make a marvellous demand upon our production. The quantity used now, although only a modern outlet, is beyond conception, and as this trade is increasing rapidly, the demand may fairly be expected to continue and increase considerably. Nothing can be more interesting than to see the activity at the gigantic yards, on both banks of the Clyde and elsewhere in this growing and most important Iron industry of the British Empire. Iron is not only in our steam ships the pioneer to commerce, but in every social phase is the willing and useful handmaid of civilization at home and abroad. Our floating docks counteract the disturbing element of the tide in the mighty deep. Iron ships defy the dangers and steam triumphantly over the mountain waves of the Atlantic, gallantly making their

way into foreign harbours, to be greeted by thousands of spectators sustained, perhaps, on Iron floating landing stages. We make Iron houses, Iron chapels, Iron shop shutters, Iron girders for houses, and now Iron roads for the trams, which are fast superseding the old inconvenient omnibuses. If we perforate the earth in search of its mineral treasures, the first sod is turned with Iron, the pit is sunken with Iron implements, holes drilled in the hard rock for blasting powder or dynamite to remove the obstructions are made with Steel; roads in the lower depths of the coal and Iron levels are made of Iron; the waggons of Iron, the cage is made of Iron, the rope is made of Iron, the wheels and the steam engine are all made of Iron, and the brilliant gas which now illumines my pen could not come into the office without Iron. " Ab initio" the retort is made of Iron, the purifier of Iron, the gasometer is made of Iron, the great mains of Iron, and the small gas pipes of wrought Iron. It is true the coal yields the gas, but this wonderful production, which seems to defy and subjugate the very laws of nature itself, and by its illuminating power turns night into day, could never have been perfected without Iron appliances from beginning to end. We have endeavoured to cite some of the purposes for which Iron is used, and which have absorbed the 4,870,074 tons in the home trade of pig Iron consumed in the puddling furnaces and Bessemer Pots and made by them into malleable Iron and Steel during the last twelve months. There are hundreds of purposes for which Iron is used, which cannot be mentioned in a work of this kind.

Suffice it to say, we live in an Iron Age, and we believe that Iron will continue to be introduced into new constructions and manufactures, at present unpremeditated, either by the engineer, the architect or the artizan workers in Iron, in this or any other countries.

To assist the reader we recapitulate in the following synopsis the figures embodied in the above statistics:—

		Tons
Gross quantity of Iron made in 1872		7,250,000
Add to which, Stock in Scotland		
absorbed during same year	296,000	
Out of Store in Middlesboro'	1,800	
Out of Ironmasters' Stocks in Middles-		
boro'	25,000	
Out of Makers of Forge Masters and		
Iron Founders' Stocks in Stafford-		
shire, Shropshire, South Wales,		
Lancashire, Yorkshire, Cumberland,		
Northamptonshire, Gloucestershire,		
and Durham	300,000	
Old Iron and Scraps Remanufactured,		
including old Cast Iron Remelted .	100,000	
Therefore, the gross Stock was in 1872		7,972,800
Exported of this Pig Iron	1,332,726	
Consumed in Foundries in the		
United Kingdom	1,770,000	
Balance consumed by the Puddling		
Furnaces and Bessemer's Conver-		
ters and made into Malleable Iron	4,870,074	

On reviewing the Iron Trade for 1872, the cause of the extraordinary rise in price must not be looked for exclusively in the commercial incidents of that year. Certainly without the great volume of demand which came upon us in 1872, £16 per ton could not have been reached; at the same time it will be well to remember that from 1866 to 1870, was perhaps as

flat a period for the Iron Trade as we can recollect, prices during this interval ruled very low, placing Iron at the disposal of architects for constructive purposes, at available prices. During this period girders, bridges, and Iron roofing began to be adopted more generally. The long run of low prices (invariably the case) gave the merchants in all parts of the world an impression that prices would go lower, and under this illusion one and all willingly reduced their stocks to the lowest ebb. In the beginning of 1870, buyers were more disposed to operate, but the subsequent advent of the Franco-German war, cast a gloom over all great staple trades, merchants and consumers of Iron became more cautious, adopting the old tactics of adhering to the reduced stock system, adopted over the previous four years. During the year of the war trade remained quiet, just holding its own without fluctuation or change in the prices of bar Iron during the whole of the year 1870. Although it was not perceived at the time (the course of the trade since has proved that), at that period the consumption of Iron was quite equal to the supply; the steadiness of the market during the whole year may be taken as a proof of this fact. In the beginning of 1871, although the war was raging before the walls of Paris, it was thought that better prices might be obtained as the year progressed: puddlers were now only receiving 8s. 6d. per ton in Staffordshire. The Gentlemen of the Streets completed the term of their directorate of France at Bordeaux, peace was made by M. Thiers, and all European nations began to

think more of applying their capital and energies to the development of trade and commerce, and were willing to forget the horrors of that devastating conflict by which our gallant Gallic neighbours suffered so much in men and money. A large trade was done during 1871, with advancing prices in the closing months of the year; and although the incipient stages of a favourable reaction were apparent on all sides, old merchants had no idea of the expansion and increase of value in store for 1872. The rail makers in Wales, and the pig makers in Middlebro' at this time sold freely both rails and pigs, probably under the influence of timidity in regard to the Money Market, which the enormous French loan, then on the market, looked likely to derange. The Alabama question, prominently revealed just then, likewise a dark cloud in the political horizon, which no doubt contributed to the large sales of pig and rails above referred to. The general activity which prevailed in all departments at the beginning of 1872 imparted considerable stimulus to mining enterprizes in all parts of England, and efforts were made to raise a supply of Iron ore adequate to the smelting powers and requirements of the 916 furnaces capable of receiving the blast. By the increased energy of mine owners, the output 1 of 1872 has reached 19,000,000 tons of ore, against 16,000,000 for 1871, and much larger quantities of Spanish and Elba ore have been imported than heretofore for the use of the South coast, Welsh and Scotch smelters. efforts of the masters, however, we regret to say, have

<sup>1</sup> We estimate this increase.

been to some extent paralyzed by the unwillingness of the miners to co-operate manfully, in furnishing the required supplies; it is fair, however, to mention that this dogged indifference to regular and constant working, applied more to the men on the West coast and in Scotland, than other districts; the miners in Northamptonshire, East Lancashire, and West Cumberland, notwithstanding that labour in the two latter districts is perhaps more scarce than some others, have worked more regularly, received good pay with thankfulness, and performed fair work for their money without grumbling. The hæmatite ores of these districts having been turned out in much larger quantities, materially assists in swelling the aggregate output to 19,000,000 of This circumstance is the more gratifying from Probably the fact, that the hæmatite of North Lancashire and the most valuable Cumberland is decidedly the most valuable raised in iron mine in the the kingdom, the price ranging last year for good world. qualities has been over 30s. per ton, the demand continued unabated up to the close of the year. The famous Park Mine, the property of the Great Steel Park mine Company at Barrow, brought to grass no less than 365,000 365,000 tons during the year, the same Company, by this and other mines of theirs, turned out in all 660,000 tons in the year. Much might be said in favour of other splendid properties, among which may be Most mentioned the Salter and Escot Park, The Millom, Cumber-The Escott Park, The Park, and various others in the Hæmatite "Eldorado" of Frizzingdon, where the best ore is raised, and the best Iron in the world made, for the manufacture of a peculiar Iron and Steel properly

tons.

named after our illustrious neighbour, Mr. Henry Bessemer, of Denmark Hill, who invented the wonderful process which has already dispensed with puddling in its manufacture, and produces an article both of Iron and Steel of superior quality; and is now being rolled into rails, and tyres, which readily sell at fabulous prices, and must in the end cause the name of Bessemer to be cherished by metallurgists of future ages with honour and respect. For while the Bessemer process acknowledges and accepts with gratitude the efforts of Dud Dudley, and the late Abraham Darby's introduction of coal for smelting; Cort's1 invention of Groove Rolls, and Neilson's hot blast; Bessemer discovers fuel in the Iron itself, which with inexpensive oxygen gas, increases the heat without cost of coal or coke, and by his patent process burns out of the metal all impurities, leaving in the cauldron pure Iron or Steel charged afterwards with any given quantum of carbon necessary to regulate the quality of the latter. Notwithstanding the great success which has attended this process; we believe it is at present only in its infancy; in another few years, instead of seventy-six boiling cauldrons vomiting forth in England their spangled stars of molten silicon and metal; if we live, we shall have to report these melting fiery boilers by hundreds, perhaps in after years by thousands; so admirably is this system adapted to develope the Iron trade of this country. Before we leave this part of the subject, we may mention that we have now at work seventeen

<sup>&</sup>lt;sup>1</sup> Cort invented the puddling furnace, by no means a good one, and but for a subsequent invention of the Refinery, would have been comparatively useless.

Bessemer works in this kingdom.1 One of these concerns alone, the Great Barrow Steel Company, converted 130,000 tons of pig Iron into Steel, out of which the same works rolled during the year 104,000 tons of Steel rails, tyres, &c., and manufactured at their own sixteen blast furnaces all the pig Iron consumed in this enormous produce of rails, &c., without a single puddling furnace, or puddling in any way. The names of all the Bessemer works, with the converting power of the pots and all particulars of the process, will be found in the Appendix to the "Guide" of this book. Looking at our gross exports of Iron, the shipments of pig Iron preponderate in a marked degree. Clyde being prominent as a source of supply, the export of bar, angle, and rod Iron, exhibits a decrease in quantity, if compared with 1871; our trade for these kinds with Italy, Turkey, and India, shows a decline on the year, rails likewise exhibit a considerable decrease in quantity. The United States was our best customer, the North American Dominion, Germany, Peru and Australia, coming next. The United States took half the whole quantity of rails exported. The States were likewise our best customers for hoops, sheets, and plates; Australia, India, and the Dominion, consecutively followed the States in quantity for these kinds. Again, the great Republic took two-thirds of all the tin plates we exported, and three-fifths of the large quantity of unwrought Steel shipped by Mr. Isaac Jenks, of the well known Minerva works and others, was taken by the United States of America.

<sup>&</sup>lt;sup>1</sup> For particulars see Appendix tables.

# CHAPTER II.

# COMMERCIAL REVIEW OF THE YEAR 1872.

Opening price of Scotch and Middlesborough pigs.

THE price of marked Staffordshire bars in January, 1872, was £11 per ton. The price of Scotch pigs at the opening at Glasgow was 72s. 6d.; in Middlesborough the price was 71s. 6d. At the January quarterly meeting Staffordshire bars were advanced by the leading houses £1 per ton, followed by another advance of the same amount on the 5th of February, which left the price at £13 per ton. On the 11th of April and the 17th of May, consecutive advances of 10s. were made, which left the price at £14 per ton. In June £2 more was added, and accordingly at the next quarter day the price ruled at £16 per ton. A much greater advance in the price of sheet Iron took place than in bars, the pro rata scale, which for half a century had regulated the relative prices of sheet with other kinds of Iron, was ignored, and in June and July singles, for prompt delivery, were sold as high as £21, and frequently as much as £23 was paid for Iron of this class; the demand for sheets during these two months being so much beyond the capacity of the Staffordshire mills to roll the requisite supply. In the month of August the demand appeared to falter, and at the close, it was evident to all, that orders were being held back. A

general impression now prevailed in buying circles, that the highest point had been touched. A sharp re- The action set in; middle men who had bought for the price rise, became nervous, and offered their stocks consider-July. ably under makers' prices; the action of these speculators alarmed buyers to a great extent, the buying diminished in a marked degree, and on the 1st of October marked bars were reduced £2 per ton; the middle men still undersold the makers at their own doors. which appeared to disorganize the Staffordshire trade in a greater degree, and induced buyers to hold aloof. On the 1st of November a further reduction of £2 was declared, leaving bars at £12 per ton; this fall of £4 had the effect of disorganizing the whole trade. No commensurate reduction having in the meantime been made either in coke, coal, or mine, the pig makers were compelled to reduce the pig Iron to their regular customers, without any reduction in the above minerals, or even wages; and the manufacturers were making and selling Iron at £12 per ton, without any abatement in either coal or wages, which presented in many cases a clear loss on the working of the mills and forges. Most of the manufacturers reduced their make consi- Iron had derably, and put the forges and mills on short time for in value want of orders. Notwithstanding the reduction, except quite £5 per ton. at a few of the leading houses orders were scarce; thus matters progressed until the end of November, the second class makers working at an absolute loss. As December opened the impression gained ground rapidly among the merchants that prices had touched the lowest point. Numerous orders were simulta-

Favourable reaction in December.

neously thrown on the market; the general feeling changed for the better, the market hardened, the makers became indifferent to large orders, and although no official advance was declared, prices rallied all round. Second class Iron went up during the month from £10, the lowest point, to £11 5s. Marked bars, although really worth more money, remained at £12, without any official change except notices from the Earl Dudley, W. Barrows & Sons, and John Bagnall & Sons, that further orders could not be taken, except at prices ruling when such orders were executed. During the same month some misunderstanding appeared to exist with the puddlers and millmen, and the masters, in South Staffordshire; this we are happy to say has now been amicably settled by the masters and men themselves.

In the Middlesborough district the makers have been hampered to a great extent by the miners over the whole year, the furnaces having often been on the point of damping down through scarcity of Iron ore, which the miners persistently refused to raise, except on the hand-to-mouth principle. Coal and coke have more than doubled in price, railway trucks scarce, and difficulty experienced in the locomotion of metal from furnace to port, shipments were often delayed through the inability of the railway company to serve the increasing necessities of the district. The Iron-workers have been kept tolerably steadily at work, all difficulty on the wages question having been settled here from time to time by arbitration.

There are 130 furnaces in blast in the Cleveland district, and 19 new ones in course of erection:

1. The Lackenby Iron Co. are building one new furnace. 2. Bolckow, Vaughan & Co. are building one new furnace at Eston. 3. Cochrane & Co. are building one new furnace. 4. W. Whitwell & Co. are building two new furnaces. 5. The Consett Iron Co. are building one new furnace. 6. Rosedale and Ferry Hill Iron Co. are building two new furnaces; Downey & Co. are building two new furnaces at Coatham Iron Works; the Tees Bridge Iron Co. are building two new furnaces; Robson, Maynard & Co. are building two new furnaces at the Redcar Iron Works, Coatham; T. Richardson & Co. are building three new furnaces at West Hartlepool. 7. Hopkins, Gilkes & Co., Limited, are building two new furnaces; most of these being still larger than those lately introduced into this district. The make of pig Iron for the year is 1,968,972 tons, against 1,884,239 tons made in 1871; the reduction in makers' stocks is 25,000 tons, out of public stock 2,800: this make exhibits an increase Greatly increased of the year 1872 over 1871 of 84,733 tons. Prices make in ranged during the year between 71s. 6d. and 122s. 6d. Middlesper ton; most of the makers, however, had sold fair borough district. quantities for forward delivery at earlier prices, and on this account were unable to avail themselves to a great extent of sales at the highest figure; considerable sales were made for deliveries of Iron by the makers for 1873, at prices ranging from 82s. to 100s. for No. 3. No. 1 has been scarce all the year, owing to the German demand. At the end of December No. 1 was marked 108s. to 110s. F.O.B. For manufactured Iron a steady trade has been done over the whole year; the

makers in Cleveland were comparatively free from excitement during the months of May and June, and booked orders at from £10 to £12 10s. per ton for bars; plates from £11 to £12 10s., which kept the works going over the months of October and November, while the Staffordshire houses, at the same time, were suffering from a sharp reaction of prices in the general market. South Wales and Monmouthshire progressed steadily in the manufacture of bars and rails, without interruption, throughout the year 1872, the works being fully employed on rail bars, which are the great staple of the South Wales district. Owing to the great proportions of some of these establishments, large orders were booked by most of them in the early part of the year, at from £8 to £9 per ton. Coal, in the meantime, had advanced 50 per cent., which has very much curtailed the profits of these establishments; indeed, the year's work, to several rail-making firms, has been anything but satisfactory in point of profit, and as was justly remarked by one of the greatest makers. the profits this year have been insignificant. Several considerable advances in wages having been conceded to the colliers and Iron workers in this district during the year, and as the demand for rails fell off in the later months, the Welsh masters gave notice to reduce wages ten per cent.; these notices expired at the end of the year, when the men struck for the old prices, and have remained on strike since that time.1 The price of rail bars ranged over the year from £9 to £11 10s. per ton; some few sales were made at £12 10s.; rails began at £8 5s., at which

<sup>&</sup>lt;sup>1</sup> We are writing in January 1873.

figure or a little more, orders for the bulk of the make were taken in the early part of the year. June and July the price was nominally called £11 to £12 10s., but very few, if any, orders were booked at these figures by the large houses. The works are at this moment 1 very nearly all standing for want of This strike coal, through the colliers' strike, which appears, as far collapsed on the 18th as we can judge, likely to continue. There have been of March men submuch larger importations of foreign ore to South Wales during this than in any former year, the new imports being principally from Spain. The export of rails fell off considerably, 947,548 tons only were exported in 1872, while 1871 absorbed for foreign countries 981,197 tons, giving an excess to the for Rails export of rails of 1871 over 1872 of 33,649 tons; this falling off in the foreign demand explains the scarcity of orders, after the highest prices were de- Serious clared. The make of pig Iron in Scotland in 1872 in the was 1,090,000 tons, which is 70,000 tons below the produce of 1871, 106,000 tons less than the yield of 1870.

The deficiency in make of 70,000 tons, with the average price for the year at 101s. 10d. per ton, or 43s. above the mean price of the last twenty-seven years, is a fact worthy of notice, and one furnishing matter for serious consideration. High prices invariably stimulate production, and vice versâ. Here, the highest prices accompany a large reduction in the make during a vear which has witnessed unparalleled demand, both for home and foreign consumption. The cause of this

collapsed of March, mitting to masters terms.

Falling off in the export last year.

decrease quantity made by Scotland.

time our great emporium for pig Iron, is a subject of <sup>1</sup> January 1873.

decline in the producing powers of Scotland, up to this

sufficient importance for the attention of economists and statesmen. It is a mistake to suppose that there is any scarcity of Ironstone in Scotland; this is not so, and therefore cannot be the cause. Ironmasters have abundance of mineral in the crust of the earth. The canker worm, which seems to be undermining the progress of the Iron trade in Scotland, is the dilatoriness and unreasonableness of colliers and miners, who have kept the Scotch masters in fear and uncertainty over two-thirds of the last year. If these men continue their present vexatious course, Scotland cannot expect to hold her own against other districts here, or in foreign countries, where men work regularly, and when they are well paid, conform to reasonable and honest rules for the good of themselves and their masters. The number of furnaces in blast during the year was 127, the same as 1871. number of furnaces in blast on the 25th of December was only 115; 12 having been damped down in consequence of the strike of the colliers, which reduces the make since the damping of the furnaces at the rate of 78,000 tons per annum. The stocks in Messrs. Connal's 1 great store, on the 29th of December, amounted to 106,919 tons; makers' stocks, 87,081 tons; total stock left in Scotland, 194,000 tons. In 1871, the same date, Connal's stores held 359,860 tons; Forth and Clyde Canal Company's stores, 12,865 tons; in makers' hands, 117,275; total stock

Cause of the falling off in the make.

in 1871, 490,000 tons; which shows an absorption out

 $<sup>^{1}</sup>$  To-day, August 8, 1873, the stocks at Connals are only  $44,\!800$  tons.

of stock of 296,000 tons during 1872, leaving the enormous deficiency in the same year of the stocks of pig Iron in Scotland, at no less than 296,000 tons. The available balance now in Ironmasters' hands and Connal stores, only 194,000 tons. This circumstance, coupled with the increased exports of 1872, and the decline in the make of 96,000 tons, together with the prospects of good demand for 1873, furnishes sound data from which conclusions may be drawn, with regard to the average price of Scotch pig Iron for 1873. The tables below, copied from the synopsis of Messrs. Feldtman, of Glasgow, which may be implicitly relied on, will perhaps render the large figures above more easily understood:—

Official Statistics of Sc	otch	Pig Iron.	
-			Tons.
Stocks end of 1871 .			490,000
Production during 1872.			1,090,000
			1,580,000
Consumption in Foundries, 1872		270,000	
do. Malleable Works ,,		200,000	
Exports, Foreign ,,		616,933	
do. Coastwise ,,		224,695	
do. by rail to England ,,		74,372	1,386,000
Stocks end of 1872			194,000
1872, decrease			296,000
Stocks end of 1870			655,000
Production during 1871			1,160,000
Consumption in Foundries, 1871		275,000	
do. Malleable Works ,,		190,000	
Exports, Foreign ,,		512,479	
do. Coastwise ,,		303,494	
do. by rail to England ,,		54,027	1,335,000
Stocks end of 1871 .			490,000
1871, decrease .			175,000
End of 1869			620,000
During 1870			1,206,000
•			1,820,000

During the year under review, the foundries in Scotland have taken 270,000 tons, and the malleable Iron works 200,000, for consumption; exported abroad, 616,955 tons; ditto coastwise, 224,695; ditto by rail to England, 74,372 tons; which gives 1,386,000 tons as the total clearance of Iron sold and delivered during 1872 in Scotland. The table, page 28, will show the countries abroad which have taken the largest quantities of Scotch iron.

We have had great fluctuations in prices on the Glasgow exchange, during the year under review, the lowest (in February) was 72s., the highest price, established in July, reaching 137s. 6d., on the 25th of that month. A reaction now commenced, which continued, with one remarkable interruption, of short duration, until November, when the price descended to 87s. 6d. In this month, a steady advance commenced, which, by the 31st of December, had reached 119s. 6d. cash, closing with higher prices in prospect. The great change in the general market value of Iron, during the first six months of the year, accounts for the advance in this commodity, and the marvellous oscillations in prices which we have witnessed during the year are due in a great measure to the idiosyncrasy of those, who had

difficulty in discarding old traditions on the one hand, and spirited buyers on the other, who saw looming in the distance results which must follow the rising value of Iron on the market, in the face of the reduced stock, increased consumption, and a craving demand for Scotch Iron for export, to an extent never before witnessed. The conduct of the great operators for a rise has been criticized, sometimes perhaps unjustly. The market was open to all, and the results now prove that the high prices paid were only what the Iron was worth, and is worth to-day, and still continues to fetch these high values readily in the forges and foundries of this and other countries. It must not be forgotten that no make of pig Iron in the world can replace Scotch, for foundry purposes. Everywhere, as a mixture, for reasons known to all, it is indispensable; a little Scotch No. 1 will give fluidity in the casting pot to inferior lower numbers of continental makers: hence the constant demand for Gartsherrie, Coltness, Langloan, Summerlee, or Shotts No. 1, at almost every foundry of note in Germany, France, Holland, our colonies, and the Great Republic of America. This demand must always exist, in the scotch the same ratio, until some other district can produce Iron, best melting Fig equally valuable for foundry purposes, to the splendid foundry brands above referred to. During the month of January, work in the world. in which we write, the Scotch market is well sustained, prices having reached 138s. 6d. for warrants, cash. The tables below will enable the reader to see at once the different countries which have been the best customers for Scotch Iron, the large figures, which re-

present Germany, United States, and Holland, being principally made up of Scotch.

Board of Trade Returns, 1872, showing the Export of Pig Iron of the United Kingdom.

Articles, and to what Cou	ntric	s Expo	rted	Mor	nth	Yes	
				1871	1872	1871	1872
PIG IRO	N			Tons	Tons	Tons	Tons
To Germany .				9,635	19,917	203,284	313,477
,, Holland				13,188	40,659	246,092	349,405
,, France .				5,787		71,265	90,200
,, United States				8,953		190,183	193,957
" Other Countries				18,398	25,022		385,687
Total			.	55,961	101,235	1,057,458	1,332,726

The trade in North Staffordshire has progressed steadily, the mining department having had the most prosperous year on record, and made good profits. The universal complaint of a scarcity of coal has often been heard here, more, however, to the inconvenience of the china and porcelain manufacturers than the Ironmasters. The masters here were more fortunate than their neighbours in the South, in avoiding large orders at the lowest prices. We know of one large firm here who also sold freely at high prices in July. The wages question has likewise created less difficulty for the masters, than in Scotland and Wales. A large business has been done during the year, in hoops, plates, and bars, but on the whole remunerative prices

<sup>&</sup>lt;sup>1</sup> We can state as a fact that one manufacturer, so urgent was his necessity for coal to complete the firing of one of his ovens, that he seized a cartload in the street, and bought horse, cart, and coal from the owner in order to have the coal.

have been realized, but it must not be forgotten, that even in a highly favoured district like North Staffordshire, greatly advanced prices in the article produced do not yield profits to the manufacturer in the same enhanced ratio.

The output of ore for Northamptonshire, during 1872, will be 1,000,000 tons, by far the largest annual yield ever known. With the exception of one concern, which is idle altogether, the furnaces have worked regularly, and the output of Iron will considerably exceed that of 1871. The demand over the year has cleared off the makers' stocks on the pig banks of the furnaces, which are left now lower than ever they were. The greatest activity has prevailed during the whole year, in the famous hæmatite districts of Lancashire and West Cumberland, and a much larger output of hematite ore has been brought to grass than on any former year. One concern, the great Barrow Steel Co., raised from the Park Mine at Barrow alone 365,000 tons of ore; the mines at Millom and the Frizzingdon District have been more productive this year than ever, and as the quality is improving, rather than otherwise, the ore is eagerly sought after by the Iron trade in all districts. All the pig makers have been particularly busy, and fabulous prices have been paid all the year for the famous hematite makes which are available for the market; particularly those produced in the Barrow and Whitehaven Districts, these pigs being so much in request at the Bessemer works in different parts of the kingdom. The miners have worked fairly, and although labour is scarce, there has been no serious wages

difficulty here during 1872. Both for mine owners and Ironmasters, 1872 will be remembered as a prosperous Having closed our review of 1872, our friends will expect a word with regard to the prospects in store for the Iron Trade during the year upon which we have now entered. Those who have our "ANNUAL REVIEW OF THE IRON TRADE," for 1871, will, by reference thereto, read the last sentence contained therein, which is as follows:-" From these favourable premises, we augur a year of greater prosperity to the Iron Trade than any on record during the 35 years that it has been our pleasure and privilege to address ourselves in these Annual Reviews to our numerous clients and subscribers." We believe the progress of the year reviewed above has fully borne out our anticipations, which at the time they were written might have appeared a little sanguine. Now, with regard to 1873, the prospects of the Iron Trade are good, and with the exception of the unsatisfactory state of the labour market, in Wales and Scotland, we can observe nothing particularly adverse to the sound progress of the trade in the future horizon, which, by the wisest, can only be dimly seen. It is true, the high price of coal, while the present demand exists, will inconvenience the Ironmasters, and curtail their profits, and no abatement in the price of fuel can be expected, until a much larger output can be brought to grass. We must, however, wait with patience the advent of increased supplies: for the present this is impossible. Therefore, taking things as they are, and judging of the present situation, on all sides, as it is, and appears likely to remain, over the year of 1873, if masters and

men work harmoniously together, we believe the Iron Trade of 1873 will be prosperous in a moderate degree, and yield a fair profit to the Ironmasters for their large capital employed therein, the men will have an opportunity of making good wages, and no doubt will make greater progress in moral and social attainments than they have been accustomed to do, under the old scale of pay. The new rate will enable them to perform their social and ministerial duties with good will and alacrity, not only to their employers, but in the hundreds of thousands of small social circles, of which the Colliers and Ironworkers are the mainstay, and chief support. In 1820, the United Kingdom produced 400,000 tons of Iron. In 1826, the output had increased to 600,000 tons, and, as will be seen by the following Table, in '27 it had reached 690,500 tons. The Table will likewise exhibit to the reader the progress made in the interesting interval from 1820 to 1827.

This Table shows the comparative make of pig-iron in 1820 and 1827, taken from the *Encyclopædia Britannica*:

		1820 Tons.	Furnaces,	1827 Tons.
North Wales   South Wales		150,000	12 90	$24,000 \\ 272,000$
Shropshire Staffordshire		180,000	31 95	78,000 216,000
Yorkshire Derbyshire		50,000	24 14	43,000 20,500
Scotland .		20,000	18	36,000
		400,000	284	689,500

Mr. Kenyon Blackwell, in a paper read before the Society of Arts, in 1854, on 'The Iron Industry of Great Britain,' gives the following figures, which show the make of Iron in all countries for the previous year. <sup>1</sup>

The estimated production of crude Iron in the various countries.

		Tons.	Tons.
Great Britain		3,000,000	Russia 200,000
France		750,000	Sweden 150,000
United States		750,000	Various German
Prussia		300,000	States 100,000
Austria		250,000	Other Countries . 300,000
Belgium .		200,000	6,000,000

On referring to the above, it will be seen that Great Britain produces as much crude-iron as all other countries together.

<sup>&</sup>lt;sup>1</sup> The name of Mr. Samuel H. Blackwell and Mr. Kenyon Blackwell, of Dudley, are well known as the best authorities on this matter.

#### CHAPTER III.

#### BARROW-IN-FURNESS.

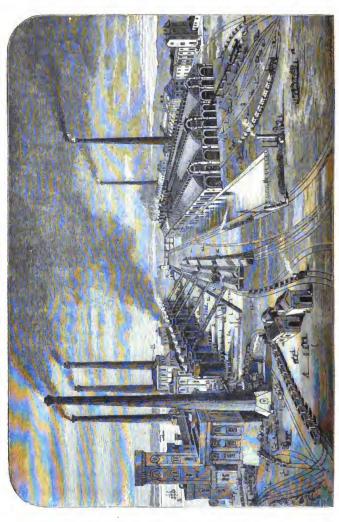
WE are quite in the dark in regard to the exact period of time when the rich hematite ores of Barrow-in-Furness were first smelted into Iron. There is however good reason for believing that the ore of this district was worked in the neighbourhood of Barrow-in-Furness anterior to the manufacture of Iron in Sussex, which is well known to have been the principal Iron county of England during the ages prior to the Christian era. This hypothesis receives considerable support from the fact, that the wood in the forests of the Barrow district had been partially exhausted for fuel as long since as the reign of Queen Elizabeth. That Iron making was carried on here in remote times, is beyond all doubt, for the name of Furness Abbey, recorded in Domesday Book, was taken from the Iron "furnesses" in the neighbourhood; the cinder heaps remain to this day; the remains of the former have likewise been discovered and pointed out by numerous enterprising metallurgical antiquarians: we have seen them ourselves. Archimedes of Syracuse, 280 before the advent of Our Lord, destroyed the Roman fleet, under the command of the famous General Marcellas, by immense chains

and grappling irons. No doubt Archimedes had greatly improved upon Tubal Cain's process, and he must have been the greatest metallurgist of his day; the Romans very probably learnt the trade from Archimedes or some of his pupils. Marcellas declared afterwards at Rome 'that by these irons Archimedes treated his galleys as though they were mere buckets to draw water with.' In the early ages of Pagan Rome, the manufacture of Iron was practised by the Romans, ore was brought from the island of Elba: some of the Roman historians mention this circumstance. All the Iron used by the good Emperor Vespasian in the construction of the Colliseum was made from Elba ore. We have carefully inspected these mines, and reported upon them as being highly valuable and rich in Iron: we landed at port Hercule. Iron must have been very valuable at this period, and during subsequent ages. On a minute inspection, it appeared to us that the partial demolition of this gigantic structure by the early Christians was effected more with the object of disengaging the precious Iron cramps, stays and plates, which hold it together, than for any other matériel originally used in the construction of the building, for this simple reason that Iron was a great necessity and realised a very high price. We observed indications on various parts of the structure of great labour in the surrounding stone-work, to extract the tie-bars which so admirably hold the building together. These efforts were unavailing in those early times, for large masses of Iron, embedded in the

The Ebbw Vale Company import Elba ore to this day.

1 When in Rome.

stone-work of the building, still remain, having defied the power of the best punches and hammers the Romans could in those days produce. It may be, for all we know, that we owe the existence of this extraordinary memento of Roman grandeur to the strength and resistance of the Iron which holds it together. No doubt Julius Cæsar or Agricola perfected the art of Iron making in this country at the first Roman invasion, for it is known that Cæsar visited the great forges at Syracuse soon after he crossed the Rubicon. Having had opportunities of witnessing the modes adopted in other countries, particularly at Syracuse, Gaul, and Spain, Julius Cæsar and his followers would be able to point out the best mode then known of separating the metal from the matrix. At this time, the ancient bloomeries were introduced in England, a method for making Iron which was followed up to the sixteenth century in all parts of the world; the different shapes and forms being wrought by manual labour, principally with hammers. blast for the furnace was created by blow-bellows, or a rude piston, fitted into the hollow trunk of a tree, the motive power being manual labour. It is very singular that this process was somewhat analogous in its effect on the iron, and produced in some degree the same results as Mr. Henry Bessemer's process, by a continual injection of blast, for, although the pressure must then have been moderate, it left the finished Iron so far exhausted of carbon, as to be malleable and fashionable into useful forms under the hammer. The next great stride, made by Cort at the end



of the seventeenth century, was the invention of the puddling furnace, which enabled us rapidly to increase the quantity; but the Iron made during the existence of Cort's sandbottom puddling furnace, was very inferior in quality to that previously produced by the old bloomeries of North Lancashire, Dudley, Sussex, and the Forest of Dean, as no scientific principle was The utter want of then involved in its manufacture. knowledge in this respect left the manufacture subject to great waste in quantity and deterioration of the quality of Iron produced. Cort, however, left a valuable legacy to posterity in his invention of groove rolls. Mr. Joseph Hall, the practical partner at the great Bloomfield Works, invented the present system of puddling, which superseded Cort's plan altogether; and designed likewise, a different puddling furnace adapted to melt and boil the metal in a molten sea of silicon, which protected the Iron from the devouring effects of the oxygen, then constantly playing on the top part of the charge under Cort's process, before the whole mass was sufficiently melted and properly decarbonized. Mr. Hall also perfected the preparation of the present tap cinder now in use, called bull-dog, for making and repairing the inside of the puddling furnaces. These improvements are entirely due to the late Mr. Joseph Hall, of the firm of Barrows & Hall (now W. Barrows & Sons), of the great Bloomfield Iron Works at Tipton, Staffordshire. This brings us to the advent of Mr. Henry Bessemer's improvements for making Iron in 1856, which have given such an impetus to the manufacture of Steel and

The Bessemer process in operation.

Iron, and in a remarkable degree revolutionized the trade. In a few words, the Bessemer process consists in the injection of constant volumes of atmospheric air, at a high pressure, through apertures in the bottom of a great iron cauldron, containing from two to eight tons of the molten metal. This process continues until the oxygen in combustion has devoured, or, chemically speaking, absorbed and dissipated, the carbon; the silicon being burnt out with the sulphur and other impurities which the Iron contains; and leaves, as Mr. Bessemer himself informs us, only traces of phosphorus in the iron: the affinity of phosphorus for Iron being so great as to defy the searching fiery ordeal in this truly burning fiery furnace. The hæmatite ore of Barrow and West Cumberland contains scarcely a trace of phosphorus. Our readers will therefore be able from the forgoing to see and understand why Iron made from these ores is and will be so eagerly sought 1 after by all the Bessemer Steel converters in the world; although the price of this ore has more than doubled during the last few years.

The Great Barrow Steel Works, with illustration. A description of the Barrow Steel Works, fixed as they are in the centre of the hæmatite district, will, we think, be interesting, particularly to Ironmasters and others, who like ourselves have watched for years the progress of the Iron trade, this the largest and most important concern in England. His Grace the Duke of Devonshire is chairman of the company; Sir James Ramsden is the manag-

<sup>&</sup>lt;sup>1</sup> The Cumberland Hæmatite ore is free from phosphorus. The Barrow Hæmatite ore is likewise without phosphorus.

ing director, and Mr. Josiah T. Smith, the Mayor of Barrow, being general manager. This company was formed about eight years since. The works consist of sixteen blast furnaces (two more in course of erection), eighteen Bessemer melting cauldrons, three rail mills, with hydraulic lifts, one plate mill, one merchant mill, and two tyre mills. These furnaces produced last year 250,000 tons of Pig Iron, 130,000 tons of which they converted into Bessemer Steel and Iron, and sold, made into rails, plates, tyre bars and forgings. The output of this class of manufacturesteel rails, plates, tyres, bars, and forgings-is at the Steel works 2,000 tons per week. They had raised last year 365,000 tons of hæmatite ore, of the best quality, at their Park Mine. The company has another mine, the Stank, two miles from Barrow, which they are now actively proving, and which from all present appearances will rival the celebrated Park's Pocket above referred to.1 The Barrow Steel Company consumes annually 300,000 tons of coke, and 150,000 tons of coal, in Iron and Steel making, and employs in all departments 10,000 artizans and workmen. They have recently erected most extensive jute mills, the gentlemen of the Steel works being proprietors (Sir James Ramsden is the chairman of this Jute Company), which for extent, perfection of machinery and architectural nobility of construction, rival any mills of the kind in Scotland or elsewhere. At present, 1,200 pair of hands are employed here; this number

<sup>&</sup>lt;sup>1</sup> At the Stank they had driven out laterally into 16 acres square of good mine, and the drivings are still in ore.

The gigantic Docks at Barrow. will be increased before the end of the year to 2,000. Two monster docks are already completed, called the Devonshire and the Buccleugh Docks, twenty-four acres each in extent. Another, the largest however of the three, is now in course of construction, to be called the Ramsden Dock, after Sir James. It will be completed next year, and will occupy an area of 200 acres, and be quite capable of admitting a vessel 20 feet longer than the Great Eastern. The Duke of Devonshire is chairman of the railway, dock, and Ship Building Company, which is on a gigantic scale. The yard is intended to employ from 6,000 to 8,000 men, and will be capable of turning out one of the largest steamers per month. We understand this company have it in contemplation to open a line of steamers of the highest class, between the ports of Barrow and New York next year, half a million of money having been already subscribed among themselves for this purpose. The market price of the produce per annum of the Iron, Steel, hæmatite mine and manufactures, we understand on reliable authority, taking it at the market value of to-day, would be £5,335,000 per annum.2 A reference to the above description of these works, for the accuracy of which

<sup>2</sup> Produce of the Barrow Steel Company and its present value, which is as follows:—

950 000 tons of Dig Toon at Of mon ton

250,000 tons of Fig fron at 9t. per ton .	2,250,0001.
104,000 tons of Rails at 20l. per ton,	
including Forgings, &c	2,080,000l.
600,000 tons of Hæmatite Ore from the	
Parks, Pocket, and other mines	
at 33s. 6d	1,005,0001.
Per annum .	5,335,000/.

0.050.0001

<sup>&</sup>lt;sup>1</sup> The railway from Cairnforth to Ulverston, Barrow and Whitehaven belongs to this company, Sir James being the chief manager.

we can vouch with confidence, leaves the works of the Demidoffs of Russia, Kruppe of Prussia, Schneider of France, and Cockerell, Imperial Foundry of Belgium, far behind, and stands out as a striking and continually increasing memento of the supremacy of this country in all metallurgical and Iron industries. Too much credit cannot be given to the noble Duke of Devonshire, for his fostering care and attention to this gigantic company. Next to His Grace, Sir James Ramsden must be highly complimented and praised for his bold conceptions, backed by an iron will to carry Mr. Josiah T. Smith, the general manager, them out. from first to last has likewise, both in the construction and conduct of the works, developed perhaps a more profound knowledge of the business than could be met with in any other quarter. Mr. Smith is the son of a Derbyshire Ironmaster, and for several years was on the most intimate terms with the late Samuel Holden Blackwell, who was admitted to be the most scientific Pig Iron maker in South Staffordshire, where Mr. Smith acquired a thoroughly practical knowledge of Iron manufacture. We were present in 1854, when the first cast of Iron was tapped at the Barrow furnaces, and visited the works again last year. It would be impossible to express the surprise and admiration felt on the last visit, at the truly marvellous progress made. In 1854 we observed only a few straggling houses at Barrow; now we found a large town, with sixty or seventy thousand inhabitants, oil mills, a well-conducted newspaper, the "Barrow Furness and North Western Times;"

imposing shops; hotels; thousands of well-built houses; wide streets, running, as they ought, at right angles, the style of the whole being in accordance with modern architectural principles; elegant churches and chapels of all denominations abounding; all public works are under supervision of the Corporation, which is ably presided over by Sir James Ramsden, who was chief magistrate for several years.1 A line of very high-class steamers run between Barrow and Belfast. So great, indeed, was the change, and bewildering to us, that we could not find our way to the furnaces which we had formerly visited. The perfection of the machinery in the Steel works, the ease and regularity with which the rails were turned out, two from one ingot, the finish and quality of the plates rolled, the great precision with which the guardian operator at the cauldron stopped the consuming element when the work was doneall excited our admiration to the highest pitch. The quality of the Steel and Iron for rails, tyres and wheels, being far superior to others, is capable of greater tenacity and flexibility, and susceptible of resisting impact force more than any others. From observations we made, its ductility is unequalled, and calculated to resist in an eminent degree, transverse pressure, tension, and compression; it has likewise great elasticity and resisting powers to torsion strains, which clearly indicate that it is the most valuable Iron made for rails, wheels, girders and tyre bars.

<sup>&</sup>lt;sup>1</sup> Since the above was written Josiah T. Smith, Esq., has been elected mayor of Barrow.

Sir William Fairbairn says 'the great advantage to be derived from the Barrow manufacture of Steel is its ductility combined with a tensile breaking strain of from thirty to thirty-two tons per square inch.'

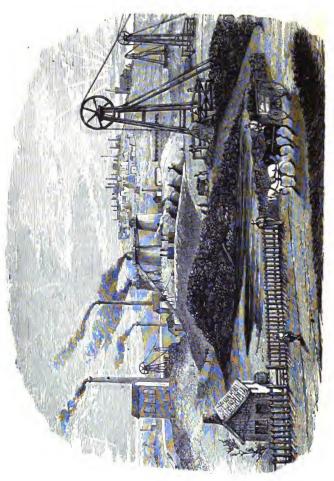
We cannot doubt the correctness of this statement, coming as it does from the highest authority on these matters in England. In our experience, which has been as extensive as most Ironmasters and engineers, we know of no other Iron or Steel which will bear anything like the tensile strain mentioned by Sir W. Fairbairn: the tests we understand were carried out and witnessed by himself. We give a table next page published by Sir William some time since, giving a minute analysis of all the ores which this great company smelt at their Blast Furnaces. The whole quantity having been raised from their own mines.

Analysis of Iron Ores used at the Barrow Hamatite Iron and Steel Company's Works, Barrow-in-Furness, Lancashire.

						O.	Solution	_					_			In	Insoluble Residue	Residn	9
°S.	Мате	Water	Sesquioxide nori to	norI	Phosphoric acid	Phosphorus	Sulphuric	Carbonic acid	Siller	AnimulA	Protoxide of Manganese	oturi	Magnesia	olduloanI residue	IntoT	Sillen	AnimulA	Lime	Magnesia
-	Park Ore (average) .	1.91	22.92	53.71	0.04	0.05 n	none none 0.14	one 0.	_	0.04 0	0.63 0	0.24 t	race	19.79	99.28	18.51	0.60	0.04	trace
*2	" (best rough)	24.0	88.46	66.42	0.03	0.01 n	none none 0.10	one 0.		0.01	0.04 0		truce	4.49	100.39	4.45	trace	trace	trace
*	" ( " fine)	89.0	90-44	63.31	none	none none none 0.09	one no	oue 0.		0.30 0	0.30	0.30 t	trace	9.11	100.05	8.74	0.54	trace	trace
7	Lindal Moor (blast)-						_	_	-	_		_							
	No. 1	2.05	78.61	55.03	0.03	0.01	0.04 none 0.04	one o.	04 tr	trace 0.24		0.57	0.19	18.31	100.05	16.11	1.67	0.03	0.0
2	No. 2	1.61	26.05		0.04	0.02 tr	trace trace 0.03	ace 0.	03 n	none 0	0.08	0.49 0	0.14	21.07	99.53	18.60	2.04	80.0	0
9	No. 3 .	5.68	70.17	49.12	0.04	0.05 0	0.03 trace 0.06	ace 0.		0.37 0	0.31 0	0.59 t	trace	25.24	61.66	22.24	2.48	0.54	0.10
1	Common	10.84	65.21	-	mber a		trace trace trace 0.24	ace tr	ace 0			_	0-14	22.38	100.56	18.67	3.42	0.0	0.0
*	Lindal Cote (puddling) .	2.85	17.34	-	none		one 4	19 0	0.60.0		0.11 6	0.00.9	0.41	20.6	100.17	7.27	1-47	80.0	trace
*6	Lindal Moor (puddling)-						-	_	_	_	_	_							
_	No. 1	3.35	86.20	60.34	trace t	trace trace 0.04 1.43	.04 1	43 0	0.08	0.43 tı	trace 2.23		0.20	09.9	100.85	,5.58	0.58	0.02	trace
0	No. 2	2.35	09.99	46.62	race t	trace trace none 5.96	one 5		0.13 0	0.23 0	9 20.0	_	1.04	16-28	100.50	14.02	1.76	0.10	trace
*	Whitrigg's (puddling) .	1.97	83.33	58.33	none	none none trace 2.53	race 2.					4.05	0.15	7.51	89.66	9.55	0.73	0.02	trac
25	Dalton's (blast)	1.80	67.14	-	none	none none none 4.45 trace 0.25	one 4	45 tr	ace 0		9 80.0	6.02 0	0.15	19.77	99.66	19.09	0.91	0.12	trac
3.	Mouzell Mine (best) .	2.58	83.94	-	0.03	0.01 none none 0.09	onen	one 0.	0 60.		0.58 0	1 99.0	none	13.17	100.66	12.37	81.0	0.50	60.0
-	" (average).	1.40	69.41	-	none	none none 0.03	.03 m	90.0 auou		0.05	0.05 0	11.0	0.13	26.27	99.48	25.92	1.53	20.0	0.0
15	Newton Mine (blast) .	3.08	19.22	54.35	racet	trace trace trace none 0.01	ace n	one 0		0.15 0	0.13 1	1.09	0.14	17.94	100.17	15.44	2.13	90.0	trac
9	Trawink (blust)	6.9	61.30		0.00	0.01	trace none 0.02	O euc	-		0.24	.01	82.0	29.73	99.75	26.78	2.54	0.16	0.0

. Used for making Iron for Besemer process. Nork.-The Alkalines were not determined.





### CHAPTER IV.

SOUTH STAFFORDSHIRE, OR THE 'BLACK COUNTRY.'

It has been known from ancient times that Staffordshire was rich in Ironstone and Coal. Plott often refers to this circumstance in his history of Staffordshire. Even in more remote ages, during the Roman occupation, Iron was manufactured in the neighbour- The Earl hood of Dudley by primitive means then in vogue, ley's vast charcoal was made from the wood of the dense domains. forests which at that time overspread the undulating territory, now in the possession of the Earl of Dudley, the priceless value of which could not be accurately estimated at the present day, owing to the inexhaustible seam of coal varying from ten to fifteen yards in thickness, the best quality in the world for Iron making and . Ironstone, which the crust of the earth contains in this vast princely domain. The 'Black Country' commences Topoat Wolverhampton, extends eastward a distance of six- graphy of the Black teen miles to Stourbridge, eight miles to West Bromwich, penetrating the northern district through Willenhall to Bentley, Walsall, the Birchills, and Worley; embracing under its darkened canopy of smoky atmosphere the townships of Wolverhampton and Willenhall, with their locks and japannery, their Manufaccurry combs and boiling cauldrons of galvanizing the Black spelter; Walsall and Darlaston, with their stirrups and

bridle bits, nuts, bolts, and other railway appliances; Wednesbury, with its gas-tubes, foundries, gun-locks, and coach springs; Smethwick and Dudley Port, with a thousand swarming hives of metallurgical industries on the banks of the Rail and Canal Companies, too numerous to mention. In this immediate vicinity we have Chance's monster glass works at Spon Lane; and the great alkali works of the same firm at Oldbury. Here, too, modestly stand the Soho works, so famous in history, where the immortal Watt made his first condensing steam-engine. Here we have likewise Muntz's patent metal works. The great works of the Patent Nut and Bolt Company, the Patent Rivet Company, the Plate Glass Company, and Joshua Horton's boiler yard, of world-wide fame, are all situated at Smethwick.

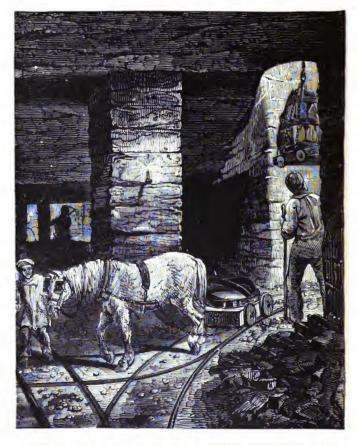
Chance's monster Glass Works. Largest in the World. Bolton & Watts. Soho Engine Shops.

smoke.

Injurious effects of acid gases.

West Bromwich and Hilltop are contiguous; here enamelled and tinned pots, kettles, and saucepans are manufactured, in all shapes and sizes, on the most ex-Oldbury in tensive scale. Oldbury lives close by, where with bated pulsation, under a constant cloud of black smoke, the vivifying rays of the sun being obscured here by the volumes of almost material carbon floating in the atmosphere. On the one hand there is the destructive effect of the smoke on vegetation, on the other, of the hydrochloric, sulphurous, and chlorine gas evolved from numerous chemical works almost in the heart of this devoted township. Bright grates and fire-irons become rusty in a single night, and all household furniture, which is held together by appliances of Iron, suffers much, and all other metals are damaged by these gases





GETTING COAL AT ONE OF EARL DUDLEY'S THICK COAL PITS.

in the same proportion. Iron mines and collieries surround the town, the workmen, on their return from work at the pits in the evening, show honourable traces of the useful labour they have performed, in the soiled garments and dirty faces they present. Vegetation succumbs altogether; scarcely a shrub, a tree, or a green field is to be seen, amid the general devastation of the surface, which presents itself for miles round. The monotony of the landscape being broken only by irregular mounds of earth and mountains of furnace cinders, the former being the disembowelled crust of the earth, removed and brought to grass by the toiling miners, in search of the valuable Ironstone and 'black diamonds,' so plentiful in the geological formations of the entire district surrounding Oldbury. The heaps of furnace cinders are the glassy refuse of molten silica, and lime, which the blast furnace discharges in her process of separating the metal from its matrix, before the Iron is consolidated and run out into the pig beds, a considerable quantity of lime being requisite with the ore and coal in the furnace to facilitate the smelting process. Nothing to be seen by day but smoke, heaps of furnace Descripcinders, and abnormal mounds of earth and coals, and tion of by night, the lurid glare of a thousand burning furnaces by night. of various colours, from the blood red of the puddling furnaces, to the yellow and blue flame of the copper works, and the chequered red and white flames, emitted in the largest volumes, from the funnel heads of the Blast Furnaces, which may be seen in the distance all round the town.

We next come to Dudley, an important town.

Dudley and its manufactures.

This is a great emporium for chains, cables, anchors, grates, fenders and fire-irons, and, above all, for wrought nails, which are brought by the nailers from Sedgley, Gornall, Brierly Hill, the Lye Waste and other districts. The nail factors supply the Iron to the men, who produce the nails at a scale of prices mutually agreed upon per pound. Anvils, vices, stove grates, and fenders are likewise made here on a large scale, and a very high class of Grates, Fenders and Fireirons are made at Marsh's works at Burnt Tree. Most of the land in the neighbourhood belongs to the Earl of Dudley, whose agent (Mr. Fisher Smith) resides at the Priory, situated in a lovely spot, the grounds of which are charming in the extreme. Frequently while walking and talking with the late Mr. Richard Smith, the former agent, in these grounds, as early as six o'clock on a summer morning, we have remarked to him that 'this is truly a lovely oasis in the "Black Country." Dudley Castle, a fine old monument of the Feudal Ages, proudly crowns the Castle Hill, in front of the Priory, and is a place of great resort for tourists and pleasure-seekers, who, by permission of the noble Earl of Dudley, have every facility for exploring this fine old ruin, which stands upon gigantic caverns, often illuminated with gas, on State occasions, to gratify the Black Country people, and, as may be supposed, his Lordship and the noble

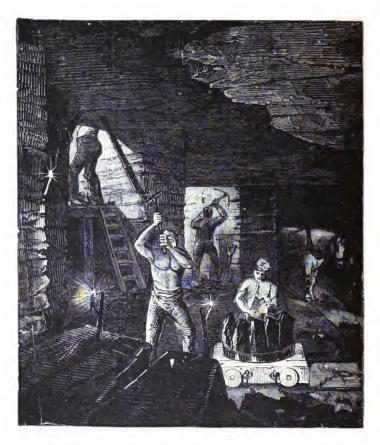
Countess are very popular with the people. Brockmoor, Brettle Lane, Wordsley, and Stourbridge, must be included in the Black Country group of towns.

Most of the land belongs to the Earl of Dudley.

Oasis in the Black Country.

Dudley Castle place of resort for holiday makers.





UNDERGROUND WORK AT EARL DUDLEY'S SALT WELLS COLLIERY,
Where the Thick Coal is obtained.

Although the atmosphere becomes purer as we get to the higher ground of Brierly Hill (Lord Dudley's famous Round Oak Works are here), nevertheless here also, as far as the eye can reach, on all sides, tall chimneys vomit forth clouds of smoke, and the sulphurous flames of the fiery furnace are observed in all Our feeble efforts to describe these districts directions. will, we hope, satisfactorily explain why it is so emphatically called the 'Black Country.'

In this, the Stourbridge and Brierly Hill district, a very extensive business is carried on in the manufacture of fire-bricks of all kinds, used in the construction and relining of blast furnaces, puddling furnaces, cupellers, and air furnaces. The fire-clay deposits here are reputed the best in England, being fashioned into melting pots and gas-making retorts, which fetch The best high prices; these bricks are exported largely, and are gasworks highly prized in all parts of the world, particularly and fire-bricks the foreign settlements of the British Empire, the in the general opinion being that they resist the highest tem- made here. peratures in smelting furnaces of any others which have yet been produced. A list of all the best manufacturers will be found in the Appendix to the Guide. Perhaps Ruffords', Mrs. Emily Gibbons', and Pearson and Harrisons', make the best quality. Mrs. Gibbons, relict of the late Benj. Gibbons, Esq., the well-known Ironmaster of the Milfields furnaces, we are informed by Mr. Jones, of the Commercial Gas Works, here stands unrivalled for the manufacture of these Gas Retorts.

world

## CHAPTER V.

# THE RISE AND PROGRESS OF THE STAFFORDSHIRE IRON TRADE.

Although Staffordshire is not the oldest, it has been for three-quarters of a century the most important Iron-making centre in the kingdom. South Wales and Shropshire may, with greater truth, be called the pioneer districts of the Iron trade than South Staffordshire. In 1750 Staffordshire could only boast of 171 blast furnaces, which had increased in 1780 to forty, and in 1806 to forty-two; the exertions, however, of Dud Dudley, whose labours and difficulties are minutely recorded in his little book, were of paramount importance, ab initio, in opening the road to Iron industries, since so successfully followed up in Staffordshire and other Ironmaking centres; we refer to the introduction of coal at this time for smelting Iron instead of woodash or charcoal; here, however, we may remark that the credit of this appliance must not be awarded entirely to Dud Dudley: Mr. Abraham Darby,2 of Coalbrook Dale, applied coal in the same way with successful results in Shropshire antecedently to Dud Dudley's ex-

The late Abraham Darby and Dud Dudley

<sup>2</sup> We think the gentleman above referred to was the great-great-

grandfather of Mr. Abraham Darby, of Coalbrook Dale.

<sup>&</sup>lt;sup>1</sup> The make of Pig Iron at this period was 30,000 tons per annum; in 1800 it had increased to 180,000 tons; and in '25 the production reached 600,000 tons for the United Kingdom.

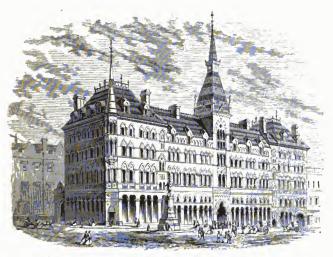
periments, which, we all know, terminated in partial smelt iron success, notwithstanding the difficulties and persecutions with coal successwhich this original Dudley Ironmaster had to contend fully for the first with. Nevertheless, Dud Dudley must take the credit of time. tapping the crop in various places of that most valuable bason of thick coal (from ten to sixteen yards thick in one seam), and applying it to useful purposes in Iron smelting, and which in after years has done so much to enrich the Ironmasters, and facilitate the profitable manufacture of this metal in the Black Country. During the final decades of the last century, Mr. John Wilkinson occupied the most prominent position as The an Ironmaster, and had extensive works at Bradley, Hall of the Iron Fields, and elsewhere, Mr. Reid, Mr. Parker, and the the Black Addenbrookes, at Moorcroft, the descendants of the latter,1 being still in the trade, played a useful and important part in the early history of Staffordshire Iron The names of Samuel and John Fereday, Firmestone, and Foley were likewise well known in connection with it at a more remote period. Mr. James Foster subsequently joined the works at Stourbridge, which were formerly built and carried on by his uncle, Mr. John Bradley, under the style and firm of John Bradley & Co., their principal manufacture at the commencement being nail rods, which were supplied to the districts of Stourbridge, Wordsley, Brierly Hill, Dudley, Sedgely, and Wolverhampton. The nail makers sent their carts to the Works for the Iron; eventually Mr. Foster arranged to deliver the Iron in horse waggons, and settle the accounts once a quarter; he was in the

pioneers Trade in Country.

1 Are now working two blast furnaces at Rough Hay.

habit of attending the Lion Hotel, at Wolverhampton, the second Wednesday of the quarter month for this purpose; Mr. Reid, Mr. Philip Williams, Mr. Wheeler, Mr. Addenbrooke, John and Samuel Fereday, Mr. Grazebrook, and Mr. Parker met on the same consecutive days at this place, and by degrees got into the habit of doing their business in the same manner. This was the beginning of the Ironmasters' Quarter Day, which arose and originated through Mr. Foster, about this time. The same name for the settling day has since been adopted by the Ironmasters, Factors, and Merchants in the Black Country, and Merchants from all parts of England continue to attend this great Exchange, which is always held, as above stated, at Wolverhampton the second Wednesday, and Birmingham the second Thursday in the month. In former years the closing meeting was held on Saturday evening, at Dudley, where a good dinner was provided. This, however, has now dwindled to insignificance, the Birmingham Quarter Day, of late years, having become the greatest, and by far the most important, of these now tri-monthly gatherings. Mr. Foster enlarged his power of production rapidly, availing himself of the valuable thick coal which abounded in the neighbourhood, and subsequently purchased the Madeley Court estate in Shropshire, which overlies beds and seams of the best coal and Ironstone in Shropshire, which was smelted then into Pig Iron for the use of the Stourbridge works; this was a great stroke, enabling him to perfect the quality of his iron, which was marked S.C. Crown. He was in the works continually, and in the

Quarter day first introduced.



THE BIRMINGHAM EXCHANGE.

The Iron Masters of the Black Country meet here every Thursday. This is the largest and most influential periodical assemblage of Iron Masters held in the United Kingdom. Most of the magnates in the coal trade and great manufacturers meet the Iron Masters here at Half-past Two every Thursday.

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ASTOR, LENOX AND TILDEN FOUNDATIONS.

early days did not hesitate to put his hand to a bar of Iron if necessary. He was a most able and far-seeing man, divested entirely of consequential airs and assumed superiority, endowed in a very remarkable degree with common sense; being afflicted with deafness, his manner sometimes appeared brusque, owing to his prompt and decisive answers. He was a decided Liberal in politics, and a truly good, kind-hearted gentleman. Mr. Foster, Mr. John Barker, and Mr. George Jones established the great Chillington works, in which he remained a partner up to the day of his death, which took place at Stourton Castle, loved and regretted by all, who, like ourselves, had the pleasure of knowing his goodness of heart. The works and the real estates, which were very extensive, were left to Mr. W. O. Foster, M.P., his nephew, who has carried them on since. Their brand of Iron has seldom been surpassed in quality by any other firm in the Black Country, and sells in the market at higher prices than some other competitors' in the same district. Mr. W. O. Foster, besides the mills and forges, has Blast Furnace establishments at Shutt End and Madeley Court, in Shropshire, and malleable Iron works at Brockmoor and Brierly Hill, in addition to the parent establishment at Stourbridge. As may be supposed, Mr. Foster left a very large property, even for an Ironmaster, in real estate, and the great Iron producing establishments belonging to him in Shropshire, Worcestershire, and Staffordshire, the fee simple of which all descended to his nephew, Mr. W. 0. Foster, M.P.

About this time Mr. Philip Williams erected the Wednesbury Oak Works, three furnaces, and the extensive mills and forges, as they now stand.1 When the works were erected they were, without doubt, the most complete in South Staffordshire. At the close of the 18th century, John and Edward Bagnall, natives of Broseley in Shropshire, who were extensive and successful mine owners, commenced at the Gold's Hill Iron Works. 2 Mr. Edward Bagnall died, Mr. John took his sons into partnership—thus commenced and progressed the great and honoured establishment of John Bagnall and Sons, which has retained its name and fame for its brand of Iron unattenuated to the present day. Mr. James Bagnall, a polite, urbane, and always kindhearted gentleman, well known to us, the late proprietor, died one or two years since, leaving the works and goodwill to Mr. Richard, his youngest brother, Messrs. Joseph and William Naylor being left trustees and managers, with a large interest in the company, and as one of these gentlemen had for half a century mainly conducted this prosperous business, the same care continues to be exercised in the manufactories which brought the Iron into such deserved repute in the market. Messrs. George and Edward Thorneycroft,

<sup>&</sup>lt;sup>1</sup> The Grand Père of the gentlemen who still carry on these great works, and continue to make the well-known brand of Iron called the 'Mitre.'

<sup>&</sup>lt;sup>2</sup> Having mines and collieries at Wednesbury, Darlaston, and West Bromwich. At a later period, John Bagnall and Sons added the Birmingham Coal Hill Company's Works, The Capponfields, Bentley and Groveland Properties, with the Imperial Works, at Wednesbury. We believe the Messrs. Naylor have an interest in these works with Mr. Richard Bagnall.

after being well qualified by practical experience at Moorcroft, under Mr. Addenbrooke, commenced the Shrubbery Works at Wolverhampton. The practical knowledge and untiring perseverance of the firm, soon brought their Iron under the notice of machinists and engineers; its quality was highly appreciated and eagerly sought after by this class of consumers. Mr. Edward being constantly in the works, Mr. George George Benjamin from the first ably managed the commercial Benjamin.
Thorneydepartment. Their Bullet Iron became an article of croft, founder of the celebrity in Manchester for certain work in the cotton machinery, and was in great request, at highly remu-neycroft & nerative prices. These works have been enlarged from time to time, and for a long period (fifteen years since) the Old Bradley Works, formerly occupied by the late John Wilkinson, were carried on by this firm. They subsequently purchased the Swan Garden Iron Works, which have been considerably enlarged. These, with the Shrubbery, constitute their present malleable Iron works, in all seventy-four puddling furnaces. This firm has a good name for plates and best Iron of all kinds, convenience for rolling the largest plates in Staffordshire, with reversing gear; they have likewise facilities for making angles of great length, and large sized rounds and squares. The present partners are Major Thorneycroft (the major is a Conservative, Major still quite the most popular man in this firm with the croft, only Wolverhampton people, the constituency being Liberal Benjamin. to the back bone), Tettenhall; Mr. John Hartley, Mr. John Hartley, Mr. John Tongue Castle; Mr. John Perks, Slade Hill; Mr. Thomas son-in-Castevens, The Birches. They have two Blast Furnaces managing

firm of G. B. Thor-

Thorneyson of Geo. Mr. John law, is partner.

at Bradley on a large colliery purchased by the firm, twelve or fourteen years since, which contains thick coal, &c., &c. The late Mr. George Benjamin Thorneycroft—the first mayor of Wolverhampton, whose name and fame can never be forgotten in the Iron trade—called his only son, the major, and Mr. Hartley, the surviving partners, to his deathbed, and earnestly urged them, by all means to forecast for a supply of coal for the works in the future, evidently foreseeing the scarcity which might soon be felt in the Black Country. The price to-day in London for house coal is 50s. per ton! This last advice was given with great earnestness.

The Great Chillington Iron Company.

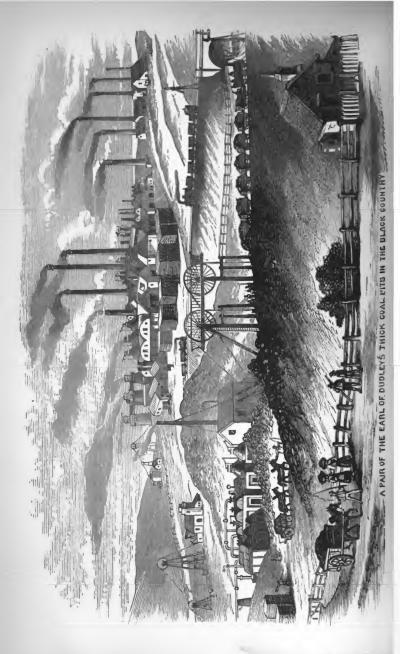
The Chillington Iron Company was the next large concern established. Three gentlemen, Mr. James Foster, of Stourbridge, Mr. George Jones, and Mr. John Barker, of Wolverhampton, entered into partnership in 1822, and leased from Mr. Giffard, of Chillington Park, 110 acres of land, within a mile of Wolverhampton. Here they found some of the richest mines of coal and iron in the county of Stafford, and built four Blast Furnaces with forges and mills for the manufacture of all descriptions of finished Iron. The works were erected after the designs and under the superintendence of Mr. John U. Rastrick, a young man who subsequently attained great eminence as a civil engineer, in the railway world. When completed, they were a model in construction and arrangement for that period. The management devolved on Mr. Barker, who raised their reputation to a high standard, especially as re-<sup>1</sup> January 1873.

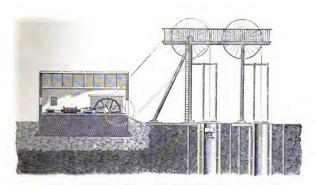
gards slit nail rods, and rails. The firm subsequently built three more Blast Furnaces at Moseley Hall, and acquired the Leabrook and Capponfield Works.

The year before his death, Mr. Barker was appointed High Sheriff for the County, being the first Ironmaster permitted to acquire a position hitherto confined to the landed gentry. His two sons, Mr. George Barker (the present chairman of the Iron Trade), and Mr. Thomas Barker, purchased the interests of the surviving partners, and still further extended the capabilities of the concern, by leasing 200 acres of mines and Blast Furnaces, under the Earl of Lichfield, at Bentley, near Walsall.

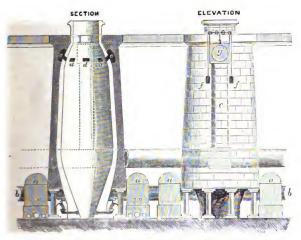
At the commencement of 1872, proposals were made to them to transfer their properties to a Joint Stock Company, which they accepted, Messrs. Barker remaining for the present as Managing Directors, and earning handsome dividends for the shareholders.

W. and J. S. Sparrow, at an early period, had william Bilston Mill. Mr. J. S. Sparrow died, upon which an Sparrow. arrangement was made, which closed the partnership; but subsequently, Mr. John, the son of the said deceased, joined, and remained a partner up to his uncle's death. Mr. John still carries on the Bilston Mill, where rods, bars, and hoops, are turned out of good quality; and the Stowheath furnaces, which so much contributed to the colossal fortune made by the late William Hanbury Sparrow, who died worth from £1,300,000 to £1,500,000. These works are still carried on under the style and firm of W. and J. S. Mr. William Hanbury Sparrow was looked up to particularly during the latter part of his life,





A PAIR OF THE EARL OF DUDLEY'S COAL PITS.



SECTION AND PLAN OF MODERN BLAST FURNACES.

THE NEW YORK PUBLIC LIDEALY ARTOR, LENOX AND THIDEN FOUNDATIONS.

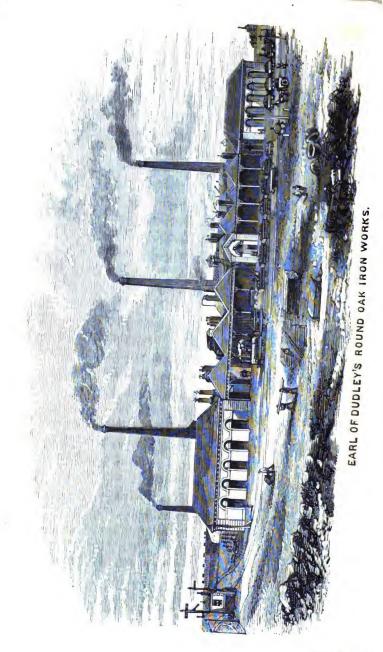
with love and respect by worthy parties of standing, for advice. He was discreet, cautious, plain in his manner, with an abundance of common sense. He established the Bilston District Banking Company, and lived to see it prosper, and become one of the best managed and safest banks in the district.

The New British Iron Company are an old leading The New house, having Brierly Hill and Corngreaves Works, with Iron Comsixty-four puddling furnaces, and six Blast Furnaces at pany. the former works. The Lion brand of Iron is well known and appreciated throughout the country. This Iron has always commanded the best markets at high prices, being known at all the smithies and engine shops of Europe. Addenbrooke, Smith & Pidcock, are the descendants of the oldest Ironmasters in Staffordshire (the Addenbrookes we refer to). The Addenbrookes worked the Moorcroft concern in Mr. Wilkinson's time; Messrs. they have three Blast Furnaces at Rough Hay, and brooke, the have obtained a patent for drawing off the gas which ants of the supersedes all others. We saw it in operation at the oldest firm Dalmellington Works, in Scotland, the other day, with pride and admiration. Addenbrooke, Smith, and Pidcock, and Wm. Ward and Sons, of New Priestfields, have always made first-class forge Iron in the district, and invariably get a top price.

The Earl of Dudley's Malleable Iron Works, are situ- The Earl ated at Round Oak, Brierly Hill. They were planned Round Oak and erected by the late Richard Smith, who, up to a short time before his death, was agent to the noble Earl. We have frequently walked through them and admired the arrangements from beginning to end. The works stand

oldest firm

of Dudley's



on an extensive plateau, close to the main Stourbridge road, the Stourbridge canal ministering most conveniently to the whole west side; a public railway, likewise, serves up to the works; the arrangements for loading and unloading coal, Iron, and all other materials, are perfect, securing the very minimum labour cost for the manual power exerted. There are fifty-four puddling furnaces, with all appliances of the most perfect description, adapted to convert the puddled Iron, made here into bars, rods, and hoops. Angle Iron of all sizes, lengths, and shapes, small bridge rails, T, and other kinds, turntable iron, crate bar iron, nut and bolt, boat beam, boat bead convex, and indeed all kinds of shapes and forms, too numerous to be mentioned. An enormous investment has been made in rolls alone. The most difficult forms and fashions are rolled at these works, which may with truth be called the model works of the Black Country. The excellence of the Iron is acknowledged and stands unrivalled in the market, and at this moment is fetching readily 12s. 6d. per ton over the ordinary1 brands of the leading makers in South Staffordshire.2 The most surprising circumstance in connection with Round Oak is the promptness with which consumers of best Iron have endorsed their approval of his Lordship's Round Oak brand, the works being of recent date compared with the S. C. Crown and others. We believe the extraordinary quality of this

<sup>&</sup>lt;sup>1</sup> We must except the B.B.H. brand which always follows the Earl's price within 12s. 6d., but it must be remembered that the price of B.B.H. is quoted at the works.

<sup>&</sup>lt;sup>2</sup> The Earl's price to-day (January 1873) for Bars is 16l. 12s. 6d. per ton; last July it was 16l. 12s. 6d. per ton.

Iron may be attributed to four prominent causes; but before giving them, we must premise the explanation by stating that his Lordship has still great stores in the crust of his large domains, of all kinds of the best argillaceous ironstone in the Black Country, and his thick coal in this Eldorado is inexhaustible. In the first place, the Earl has complete machinery for manipulation. In the second place, the best men are secured for the work. In the third place, all the Pig Iron used here is smelted and made at his own furnaces—with the pick of his own mines. In the fourth place, selection is made of his best sulphurless thick coal, for puddling and mill furnaces. Nothing but 'bull-dog' is used for fettling. Fifthly, the management, under the supervision of Mr. Fisher Smith, is perfect, Mr. William Casson, Mr. Smith's able and talented deputy, being always present at the works.

Under all these circumstances, the Earl of Dudley's Iron takes its proper position in the market, which with Bloomfield B.B.H., is the top of all Staffordshire makes, and will relatively, though perhaps gradually, continue to ascend in value, while the present favourable circumstances continue to facilitate the desirable results aimed at by the astute and able management which has always directed these works.

It would be impossible to write a chapter on Staffordshire without referring to a few of those old Ironmasters, called the leading houses; those above mentioned all belong to this class. There are numerous other makers, whose brands of Iron stand high in the market; it would be impossible for us to notice all of them in these THE NEW YORK PUBLIC LIBRARY

THE THE TOTAL

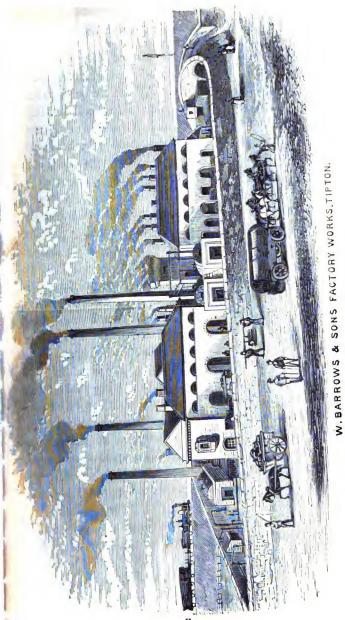


ir report of the quality of those menbe implicitly relied upon, and with a notice , and the most important of them all, we these sketches, referring our readers to the st, which contains the name and particulars of works embodied in the furnaces, mills, and the Black Country. W. Barrows and Sons, proof the Bloomfield, Factory, and Tipton, Iron have one hundred puddling furnaces, quite the number of any iron works in South Stafre, and produce 1,000 tons of finished Iron per The brand is B.B.H., taken after the names of riginators of the firm, Bradley, Barrows and Hall, s known and appreciated, not only in this country the Colonies; but its world-wide fame has caused be eagerly sought after in all parts of the world, ag preferred in Australia and other Colonies before others. It has for many years deservedly been the ost favourite English brand imported into Holland and he Low Countries, the excellency and uniformity of its quality having created a living faith in the B.B.H. brand which no other Iron made can boast of to the same extent, in the number of its customers, or degree of implicit faith willingly reposed in the quality of the article itself.2 The Bloomfield Works were erected by the above-named gentlemen a little later than 1826, having from time to time been amplified to their present dimensions. The brand remains unchanged,

<sup>&</sup>lt;sup>1</sup> See illustrations.

<sup>&</sup>lt;sup>2</sup> Mr. Chance told us that the iron made here was so valuable for certain glass-making purposes as to be worth its weight of silver.

W. BARROWS & SONS TIPTON CREEN IRON WORKS.



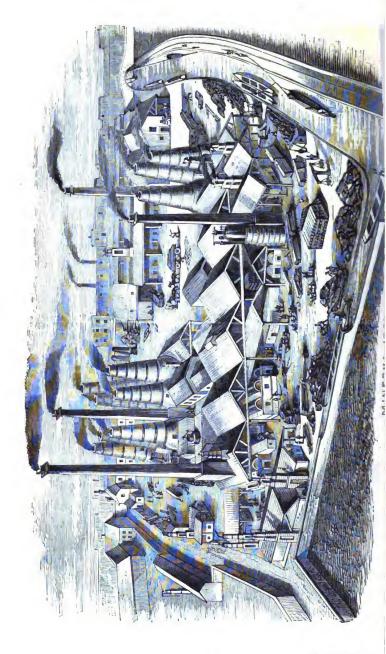
ferior mine pig iron is never used

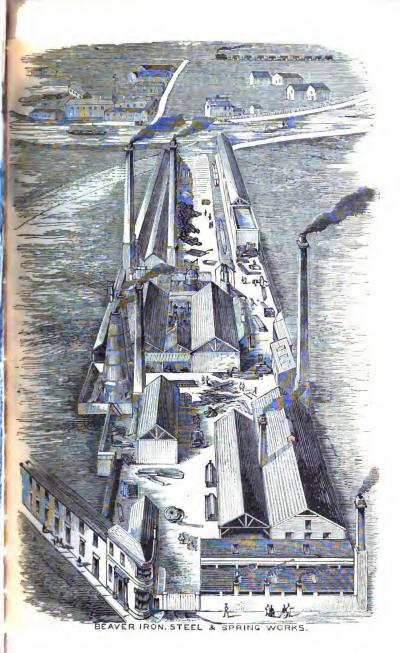
the quality, amid the changes of fifty years, has Cinder pig remained the same, unattenuated, unadulterated, always iron or inuniform, B.B.H. in quality. All the old partners have been long since dead and gone to rest, still Mr. Hall's original plan is carried out, both in the kind of pigs used, the boiling process which he invented, the best workmen engaged, and perhaps better pigs and coals used than anywhere else, with good managers on the ground day and night. This large concern belongs to the late Mr. William Barrows's sons, Colonel Barrows, and Mr. Joseph Barrows, being the managing partners, and follow their father's footsteps in attending daily at the works. The superior quality of the Earl of Dudley's pig Iron is well known in Staffordshire, in fact, it is quite the best. The name and fame of Earl Granville's Lilleshall is equally celebrated. W. Barrows and Sons purchase and use more than half the quantity of Earl Dudley's Pig disposed of in Staffordshire, and quite half the whole quantity of Shropshire Pig sent into Staffordshire, is consumed by this firm. They still adhere to their father's plan of buying none but the very best; it is therefore rigid attention to this rule, which enables the present firm to make such very uniform and matchless Iron in quality, which is seldom equalled and never surpassed by any other house. In fact, the uniformity of the quality of B.B.H. Iron is not equalled by any other house, and their quality remains unrivalled.

William Dawes and Sons are the proprietors of the Bromford Iron Works. These are large works very near to the Oldbury station on the north side of the Stour Valley Railway, and can be distinguished by the round chimneys or stacks, the diameter increasing as the stack

rises, the summits of which are considerably wider than the base. This is a very old and highly respectable The family are all born gentlemen, and educated Ironmasters, make and export nail rods largely, particularly to China, where they are highly esteemed for quality. 'Dawes and Sons' is branded on them in Chinese characters. Mr. George Dawes has the Elsecar Works in Lancashire, and W. Dawes and Sons, besides the Bromford, have likewise two Blast Furnaces at Withymoor, near Dudley. The make of Pigs here is first class. Dawes and Sons, of Bromford, stand well in the market for rods, hoops, and bars; the Iron is soft and good, their rods and hoops are exported largely by the Liverpool merchants; they make bars, hoops, rods and small and large angles, small and large rounds and squares, sheets and plates. These works have always been carried on very regularly, and the quality of the Iron is noted for its uniformity. The firm is well supplied with coal of the best quality from its own mines, and the 400 tons of high-class Pig Iron, made at their Withymoor furnaces per week, gives a thoroughly Staffordshire character to the malleable Iron they produce.

Having noticed all the most famous malleable Iron makers, before concluding this part of Staffordshire metallurgical manufacture, we must refer to the Steel manufacture, which, although not so extensive here as in Sheffield, and at Barrow-in-Furness, there are one or two concerns which claim particular attention. Twenty years since, a method of puddling Iron into Steel was discovered in Staffordshire, which, for





certain kinds of Steel, was admirably adapted to the wants of the Sheffield converters; Messrs. Solley, of Leabrook, were the first to make it.

The Chillington Company went into this trade, and were very successful in producing the article. At the same time, Mr. Isaac Jenks commenced making this article at the Minerva Works, and also since, at the Beaver Works at Wolverhampton (both of which we give an illustration of), having previously been instructed in the manufacture at Messrs. Solley's. Mr. Jenks's practical knowledge of this trade enabled him to carry the Minerva brand into all the great markets. Through his constant attention and practical knowledge of the manufacture, the Minerva brand stands unrivalled. From the commencement, the fame of Jenks's puddled Steel, so admirably adapted to the manufacture of railway springs and other purposes, crossed the Atlantic, and the demand in the great Republic has been considerably greater for this brand than any other. Four-fifths of our export of this kind of Steel to the United States last year was manufactured at the Minerva. These works have grown, pari passu, with the demand, and no doubt the proprietors' wealth in the same ratio, and now make all kinds of the best Steel, which is preferred in America to the Sheffield makes, for while Iron was unsaleable and low in price, the demand for Jenks's Steel continued to increase for America, which brought relatively high prices, and, no doubt, fair profits. And although he commenced with slender means, the first in this speciality, he is now, without doubt, one of the most wealthy Ironmasters in Wolverhampton. Mr. Jenks is a staunch Wesleyan Methodist, very quiet, and unassuming in his intercourse with others, unexalted in 'iis own estimation by his accumulation of wealth. He was unanimously appointed Mayor by the Corporation of Wolverhampton, upon which the Superintendent Minister was made the Mayor's Chaplain, and the Corporation attended Darlington Street Chapel, with their Mayor, to hear a Methodist sermon, in their Corporate capacity. Mr. George Benjamin Thorneycroft was the first, Mr. Jenks is the third Ironmaster who has been Mayor of the Capital of the Iron Trade in the Black Country.

Messrs. William Hunt and Sons, of the Brades, are the oldest Steel manufacturers in Staffordshire. This is a very old and highly respectable concern, and the article turned out is of excellent quality. They have seven puddling furnaces and three mills, with extensive converting conveniences on the old Sheffield plan; cast, shear, blister, and all other kinds of Steel are made here, of the best quality; quality, not quantity, being the great object of the proprietors. The works will be found on the left of the Dudley Road, near to the devoted town of Oldbury.

The Darlaston Iron and Steel Company took to Bills and Mills' old establishment, which had a first-rate connection for Iron and Steel; the last partner in the old firm retired with between two and three hundred thousand pounds; the Lloyds, of Wednesbury, have a large interest in these works, which are situated at Darlaston Green and King's Hill; they have thirty-

eight puddling furnaces and eight mills. They have rich and abundant coal mines, all the best ironstone measures, and in addition to their own supply sell coal largely. This firm has three blast furnaces. This is a Limited Company, which has been successful in dividends to the present comparatively new proprietors. All kinds of Iron and Steel are made here of the very best quality. Mr. Thomas Wells, of the Moxley Iron Works, has twenty-two puddling furnaces, three bar and plate mills, makes good plates, and manufactures Steel.

There are other makers of Steel in Staffordshire, particularly puddled Steel, mostly in the neighbourhoods of Leabrook and Oldbury, Solley Brothers, a Limited Company, being the oldest and largest of this class.

There is another Staffordshire speciality in Iron making, which would be understood better if we say Marshall and Mills, of the Monway Works, Wednesbury. These gentlemen, many years since, succeeded in making the best gun-barrel Iron in the world, and have for years supplied the Iron to the Birmingham gun makers, also to the British and American Governments, the quality of their Iron being approved and sanctioned by both Governments. The price they obtain now would be about £33 10s. per ton. ¹ The firm was dissolved, by mutual consent some years since, Mr. Mills having grown-up sons whom he wished to introduce. Mr. John Marshall remained at the

<sup>&</sup>lt;sup>1</sup> They make sheets and other qualities, commencing bars at 18*l*. and sheets at 24*l*., but their best quality sheets fetch much higher prices; their best bars 42*l*. per ton.

Monway Works, which has eleven puddling furnaces and two charcoal fires, and carries on the original business. Henry Mills and Sons erected the Victoria Works at Walsall, a modern unique concern, which Mr. Mills carries on in connection with his sons, making also, the same specialities which gave so much celebrity to the firm of Marshall and Mills. Mr. Henry Mills took his first lessons in Iron making from the late grand père, Mr. Phillip Williams and also Mr. John Bagnall. He was on intimate terms with our own dear friend, Mr. Hall, of Bloomfield, whom we have often heard say that 'Mr. Henry Mills knew how to make Iron.'

Since Mr. Hall's death, Mr. Henry Mills, as a practical and scientific Ironmaster, has had no rival in South Staffordshire. He is a staunch Methodist, and often boasts that his father lived and died one also. Both Mr. Marshall and Mr. Mills make a superior kind of sheet Iron, which realises a very high price in the market. The Victoria Works has seven puddling furnaces only, quality rather than quantity being the object aimed at by Henry Mills and Sons.

## LLOYDS, FOSTER & Co.

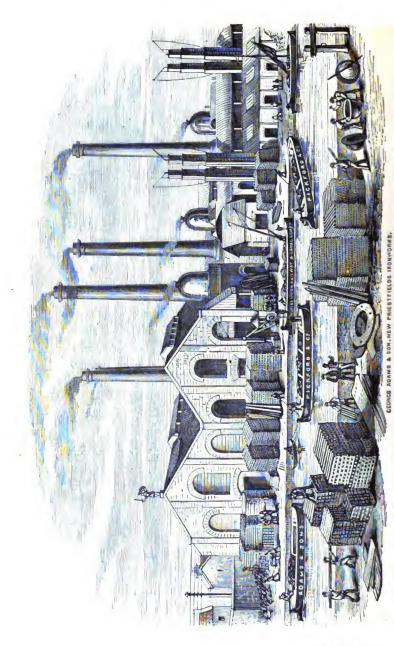
The Old Park Works, Lloyds, Foster and Co., Wednesbury, is one of the most time-honoured and important in the district, and was erected by Samuel Lloyd, who was afterwards joined by Mr. Foster. There are three blast furnaces, and most extensive engine machine shops and foundries, with lathes and

machines quite abreast with the shops at Manchester and the Tyne. This wealthy old firm built our beautiful new Blackfriars Bridge. The mines of the Old Park produced a quality of Pig Iron of the very highest class, and the high position, wealth, and known integrity of the firm, placed within their reach orders for bridges and other public works, which contributed to the wealth and celebrity of this time-honoured establishment. The proprietors were mostly 'Friends;' the late Samuel Lloyd was managing partner, with the assistance of Sampson Lloyd, during the extent of our recollection. Samuel Lloyd was never excited; firm, urbane, considerate, and kind to those beneath him: always the same. In the large transactions we have from time to time carried out at this office with Samuel Lloyd, his yea was yea, his nay was nay; he was always himself, always the same, we never heard of any bickering and disputing in respect to any business transaction of Samuel Lloyd's. The number of men employed here, in all departments, perhaps exceeds that of any other concern in the Black Country. The paternal kindness of Samuel Lloyd endeared him to the men-all artisans and workmen thought themselves fortunate to get a job, as they said, at 'Quaker Lloyd's.' The greatest kindness was shown to the widows and orphans of those workmen of this firm who lost their lives in their collieries; schools were erected at their expense, in which these orphans were educated, and when Samuel Lloyd died, their own workmen lamented his death, and the universal remark was, 'That a good man had passed away.'

This firm kept a large truck shop, which, like the works, was conducted on high moral principles; all articles were of the best quality, the prices were quite as low, and sometimes lower, than the shops. Samuel Lloyd took pride in buying the chief articles himself, particularly the tea, the bullocks and sheep; the shop was noted for the best butcher's meat in Wednesbury. He often walked up and looked over it. We accompanied him on one occasion, and were gratified to see how minutely this great man could stoop to little things, when he knew that his labour was for the good of his workmen.

The Old Park Company, seven years since, was merged into a Limited Company, called the Patent Shaft and Axle Tree Company, which, combined, is one of the largest concerns in Staffordshire, having three Blast Furnaces and eighty-six puddling furnaces, with the great foundries and fitting shops above referred to. The Patent Shaft and Axle Tree Company Limited, is one of the most prosperous and paying concerns in England, and, we believe, will always continue so. The Lloyd family have still a large interest in it.

Wednesbury is the seat of the gas-tube trade, which has become, during the last fifty years, so important for the supply of the home and foreign markets of this ingeniously made article. James Russell and Sons are the original patentees, and continue the largest and most celebrated makers, exporting their tubes in increasing quantities year by year to the great Republic, Russia, France, Germany, and other markets, where the name is so well known. This great concern is now



a limited company, under the able management of Mr. W. Smith, who is brother to Mr. Fisher Smith, agent of the Earl of Dudley. Under Mr. William Smith's management, this valuable old concern has been highly prosperous, returning large dividends to the proprietors.<sup>2</sup>

Messrs. T. and J. Roberts's great Swan foundry, established 1824, long celebrated for pipes and machinery, is situated near here at Westbromwich, and is famed for all kinds of castings for steamengines, pipes, soft and chilled rolls, and all other rolls for Iron works, where a great stroke in the general foundry business is got through. Not far distant is situated the well-known Horsley Company, established for a century or more, famed for the manufacture of bridges, steam-engines, and all other constructions in Iron. Mr. Broad is the managing partner.

## Mars' Iron Works, Priestfields, Wolverhampton.

These works were erected by, and have since been carried on by, Mr. George Adams, recently under the style and firm of George Adams & Co. The engraving opposite is made from a photograph taken expressly for the editor of the Guide to the Iron Trade of Great Britain.'

The quality of the iron made here is first-class,

<sup>&</sup>lt;sup>1</sup> Mr. Smith is Managing Director and Chairman of the Company.

<sup>2</sup> James Russell & Sons are the oldest and most extensive gas-tube makers in the United Kingdom. We believe them to have been the original inventors and patentees, and still take the lead in the trade.

Mr. Adams from boyhood having been practically connected with the manufacture of iron in Staffordshire, first as manager for Rose, Higgins & Rose of the Bradeley Field Works, whose plates and sheets under Mr. Adams' exclusive management acquired considerable celebrity in the London market. At a more recent period, say sixteen years since, he undertook the management of Wright & North's Monmoor Works, which remained under his control in all departments for ten or twelve years, during which the character of the Monmoor Works' brand for plates and sheets was raised considerably in the home markets, where their plates are well known. Mr. Adams then built the works engraved above, and has, during the last seven years, successfully carried them on.

The sheets, hoops, plates, bars, strip and small rounds and squares manufactured here, may be relied upon, Mr. Adams's eldest son being always at the works, under the constant supervision of his father whom we venture to say, as a practical man experienced in practical iron-making, is rarely equalled in South Staffordshire. We believe Mr. Adams still supervises the extensive Monmoor works, which, since the retirement of Mr. David North with a large fortune, are carried on by E. T.Wright, Esq. The Monmoor brand of Iron is well known and highly appreciated.

Any of our London friends who order iron from George Adams & Co. will be satisfied with the quality. The firm are particular in the raw material they use, and for a mixture purchase both the Earl of Dudley's and the noble Earl Granville's Lilleshall pig-iron. The works are well situated, being on the banks of the Birmingham Canal, with a small arm or wharf which runs into and intersects the works. The situation is likewise favourable for coal, pig-iron, and labour, being midway between the Bilston and Wolverhampton markets. The works, being of recent erection, are well adapted to turn out large quantities of iron, from being equipped with modern machinery abreast with the progress continually being made in metallurgical establishments of this kind.

## CHAPTER VI.

BILSTON: ITS VALUABLE COAL MINES AND IRONSTONE.

WE must crave permission to say a word about Bilston, our native township, before we close these sketches. The whole of Bilston is built upon a long slang of the crust of the earth, overlying the most valuable coal and Iron mines, taken altogether, in the world, the ten yard thick coal being better here than any other part of this wonderful deposit. Besides this, there is the new mine and fire-clay, the Bruch, Flying Reds, the Heathen coal, and the Bottom coal.

With regard to Ironstone, all the best measures are there, including the new mine, or Whitestone, Balls, Blue Flats, and Poor Robbins, all in their Bilston prime; but these valuable measures have been gotten all round the town, and, either by fair or foul means, taken from under the outer portions of several parts of Bilston proper: they remain, however, in High Street, which is the longest street here, and about one acre occupied by St. Leonard's Church, the Swan bank, and the graveyards. Bilston Church and its churchyard proper, with the parsonage, occupies about one acre of land which contains the coal and mine. with all the usual measures in the virgin state, the fabulous value of which is incredible. To give the reader an idea of the importance and value of the coal and iron mines of our native town, we give a valuation of the same seriatim below, being the price of the mines and minerals brought to grass, which foots up to no less than £41,440 sterling for the coal and Iron mine of a single acre of land, all the mines being deposited in their Bilston prime here. We have valued the materials at the price of to-day (January 1873). As this thick coal and the same mines underlie the Bilston district, the reader can form his own opinion of the mineral treasures contained therein. Our valuation has been submitted to, and endorsed by, mining authorities in the district, and is as follows:—

For the thick coal, the Heathen coal, New Mine coal, the Friesley coal, the Bottom coal, and Mealy Grey coal, are all there, and would yield in the aggregate 56,000 tons; taking coal and slack altogether at 12s., much below the present value, per ton would give a value of £33,600. The Ironstone measures known to be there are the New Mine, Poor Robbins, Balls, and Blue Flats: these would aggregate 6,400 tons. Taking the average value of these Ironstones at 22s. would yield £7,840, or a grand total of £41,440 per acre; or for the acre and a half of coal and iron which belongs to the church, This would be the gross value of the minerals and coal if they turned out well when brought to grass. From this, however, deductions must be made for Royalties, sinking, engines and machinery, labour, interest of capital, &c., &c., &c. We do not say that even at this price it would pay to make the necessary outlay for so small a piece of land. We have given this simply to show at one view the great value of mineral property in this neighbourhood.

THE PATENT NUT AND BOLT COMPANY, LIMITED.

The works of this Company are worthy of special notice, as being the most extensive in the United Kingdom for the manufacture of the immense variety of articles coming under the denomination of bolts and nuts.

The Company's principal establishments are at the London Works, near Birmingham (which is also the head office of the Company), the Stour Valley Works, Westbromwich, and at the Cwm Bran Works, near Newport, South Wales. A notice of the latter will be found on the following page.

At the London Works are manufactured all kinds of engineers' black and bright bolts and nuts, coach screws, rivets, and washers, also every description of bolts and nuts used by ship builders, agricultural implement makers, telegraph engineers, railway carriage and wagon builders, &c.

The Stour Valley Works are devoted exclusively to the manufacture of railway fastenings such as fish bolts, fang bolts, and spikes in all their endless variety, and it may be observed that the whole of these articles are made from Iron puddled and rolled on the premises. The works also contain a foundry for casting railway chairs.

Mr. Arthur Keen is the Managing Director of the works in Staffordshire, and Mr. Edwin J. Grice of the works, collieries, and blast furnaces, in South Wales. Mr. W. F. Jones is the Secretary of the Company, which was incorporated in the year 1864.

CWM BRAN WORKS IN WALES.

The Cwm Bran Iron Works and Rolling Mills, near Newport, are the property of the Patent Nut and Bolt Company, Limited, and are engaged exclusively in the manufacture of all the various kinds of railway fastenings, including fish plates and sole plates.

Attached to these works are extensive collieries and also blast furnaces, the latter producing the well known 'Cwm Bran' pig Iron, a brand which has always been highly valued, more especially for the manufacture of shot and shell.

Being at Smethwick a few months since, we were permitted to walk through the London Works. We were astounded at the facility with which the nuts and bolts were forged, and the screws cut and turned out bright and beautiful.

The nuts are made stronger and better than the hand of man could forge them. By clever machinery, the Iron is concentrated and rendered more dense and resisting, and we feel safe in saying that no forged nut can compare with them. The manufacture of the bolts was just as marvellous, as rapid, and as perfect as the excellence of the nut and screwing machines was admirable. We, however, observed one thing particularly. The Iron was uniform and of very high quality, for in the thousands of nuts and bolts that we saw made, after examining, we could not discover a single rent in punching of the nut, or crack in the heading of a bolt—the Iron pressed in the machine like plastic potter's clay.

The nuts and bolts are made with square, hexagon, or octagon shaped heads and nuts in the very highest style of workmanship. It was a great treat to us to have the privilege of seeing the machinery of these works.

## CHAPTER VII.

BILSTON: ITS MANUFACTURES.

Numbers of females are employed in japan painting THE manufactories at Bilston are not numerous; the great staple is japannery and tin plate wares, Mr. Farmer and Smith and Edrington, of the New Town, and Messrs. Jones and Rowley, of the Old Town, being now the principal makers. The japan and tin plate wares of Bilston are not of the very highest class; our Bilston friends make some very good articles, but as labour is cheaper here than anywhere else, the manufactories do a large business with the Birmingham merchants, who run the prices down when they get a chance during a bad time of trade. On this account the Bilston manufacturers have to produce an article at a lower cost to meet the Birmingham market. There is a good market on a Saturday night here, attended by colliers, puddlers, shinglers and rollers, with their wives; a large quantity of ducks, geese, and fowls are in constant demand by the Ironworkers; good beef and pork find a ready sale among these stalwart artisans, who descend in swarms from the smoky regions of Bradley, Shropshire Row, and Hallfields, to spend their money on a Saturday night.

We must, however, say that the colliers are a very quiet and orderly body of men; they may occa-

sionally take a little too much to drink on a Saturday night.

The Ironworkers are intelligent, respectable, and well behaved, and move much higher in the general social scale than any working men we know in any part of England. When the last sixteen weeks' strike of the colliers took place, we called them together in Bilston, and from the window of the Shakespeare Inn addressed the largest meeting of them ever assembled in Bilston, on the Saturday, advising them "to abandon the strike and go to work; the trade was so bad in Iron, that there was no hope for them"; they took our advice, and went to work on the Tuesday following. At the great lock-out of the Ironworkers in 1862, which lasted eighteen weeks, when all efforts had failed at reconciliation, the Earl of Lichfield finally endeavoured to bring about a settlement, but without effect. Impelled by a sense of gratitude, which the Bilston colliers and Ironworkers had imposed upon us, by giving us a majority of their votes at the Parliamentary borough We were of Wolverhampton election, which we had so recently the poll, contested in the Liberal interest, against Mr. Weguelin, far behind the present sitting member, and Mr. Staveley Hill, now Weguelin. the well-known Queen's Counsel and member for Coventry, we issued a placard, calling a meeting of the puddlers and Ironworkers; and after addressing the largest meeting ever held during the eighteen weeks' lock-out, we proposed three resolutions, which the men passed unanimously by a show of hands, which induced the masters to open the gates of their works, and the men went in on the following Tuesday and Wednes-

day, on the old terms. On this occasion, from the first, we advocated the working man's cause, believing as we did, that the masters were wrong when they locked out the men. From that time to this, now some ten years past, we are happy to say that, with very little interruption, peace, harmony and goodwill have existed between the masters and the men, although the masters have had hard times of it during eight of the ten years which have intervened.

Bilston is surrounded on all sides by Ironworks, collieries, Iron foundries, and coal mines. The famous Iron foundry of T. Perry and Sons, of Highfields, is near here, where steam-engines, chilled and soft rolls, and everything appertaining to an Iron works is made. The firm is famed particularly for blast-engines, all heavy castings, likewise the very best safes, which are well known in the London market for their excellence and superiority over other makers.

The late Mr. T. Perry was a director of one of the principal banks; he was a man of considerable influence and of unspotted reputation. Mr. Thomas, his second son, is managing partner.

Messrs. Thompson and Hatton's <sup>2</sup> Tin-plate works are situated here. Groucott's, Bradley Bridge; Messrs. Hampton, Brierton and Cole, the Bilston Sheet Iron Company, <sup>3</sup> George Hickman's works, Mr. Alfred Hick-

¹ The first blast engines which we saw started at the Barrow Steel Works were built by T. Perry & Sons, which are so much approved of, that they have retained the appointment, and since built all the blast engines for this great establishment.

<sup>&</sup>lt;sup>2</sup> Mr. Hatton the banker at the Joint Stock Bank.

<sup>&</sup>lt;sup>3</sup> Chambers and Sankey make a larger quantity of Sheet Iron than any other Ironmasters at Bilston, their quality is very good, their

man's furnaces, and Mr. G. Merriman's Lanesfield Iron Works are all in a group, beneath the curtain of black smoke which forms the normal canopy of Bilston. Here too the Iron works of W. and S. Sparrow are situated, one of the oldest and most wealthy concerns in the Black Country. Turleys' and Fowler's blast furnaces, and also the famous Capponfield furnaces, belonging to John Bagnall and Sons, emit their smoke and flame, and produce Iron of their well-known brands. All the above works are within the radius of the Bilston group.

One hundred years ago, the principal manufactures of Bilston were Iron and silver buckles, steel watch chains, snuff and tobacco-boxes, and enamelling designs in copper. Bilston, like Wednesbury, was then well stored with fighting cocks and bull dogs. Mains of cocks were fought, and at the Bilston wakes as many as three bulls were frequently baited while these cruel sports were permitted by the Government.

The cocks were kept out at walk in the surrounding districts by those who indulged in this unfeeling sport. Bull dogs were then kept by numbers of the colliers to bait the bulls with at the wakes, Catchem's-Corner and Hell Lane, a place no longer known by the appellation, or by the recurrence of this brutal sport.

Thank God! things are much changed since then. Two new churches have been erected. A large Baptist church exists here, a splendid Methodist chapel,

doubles and latten always fetch a good price in the London market. The firm is called the 'Bilston Sheet Iron Company.' Works near to a railway station.

a New Connection chapel, a very fine one, one of the best Primitive Methodist chapels in the district, besides the old St. Leonard's Church, St. Mary's, and one Independent chapel.

In 1872 the cholera raged more here than in any other town in England, when the Rev. Mr. Leigh so successfully appealed to the kind-hearted English people for pecuniary assistance. The clergyman of St. Leonard's is invariably elected for life by the house-holders; and it was at Bilston, where our late dear and ever beloved friend the Rev. J. B. Owen, devoted the greatest part of his useful life at St. Mary's Church, where his memory will ever be cherished for his great ability, unrivalled tact, Christian virtues, and untiring zeal, coupled with indomitable industry in the work of his Lord and Master.

# CHAPTER VIII.

THE BILSTON NECROPOLIS ON THE COAL MINE BANKS, AND WOLVERHAMPTON.

Being now within two miles of Wolverhampton, which is considered the capital of the Black Country, we must refer to it. Leaving Bilston then by the highway, we pass the Cholera Orphanage, and on the right, observe a little farther on, the Bilston Cemetery, which, to a stranger, has a very singular appearance, although well looked after. Situated on the very top of the old mines, Bilston the land all round for miles is devastated and thrown on the top into heaps. Attempts have been made to level the of the old coal mines. ground and recultivate the surface, but nature, after the torture which she has undergone, refuses to give her increase; the trees all withered away, the sun appears to frown on the efforts of man, and refuses to force his genial, sparkling rays through the murky atmosphere which enshrouds this devoted spot. At night the distant dim lights throw their ghastly flickerings over the graves and tombstones of this disembowelled necro- Nocturnal polis, rendering the place a source of solemn reflection on the to the midnight traveller, and of melancholy contem- grave stones. plation to a cluster of inhabitants who dwell in the precincts of the dead. The road and the country all round has been disembowelled in all directions, and no doubt if a correct survey could be made, the adits

and gate-roads resemble the catacombs of Rome, only that the excavations here are on a more gigantic scale than those of the old Pagan City. Nothing can be seen all round for miles, as far as the eye can reach, but blast furnaces and tall chimneys, vomiting forth volumes of dense smoke which form a dark canopy, resembling in some measure a moderate London fog; fortunately the latter is quickly dispelled by the sun's rays. Here, however, he seems to have lost his power; obstruction of the smoke renders a thickened state of the atmosphere a normal condition, of the country. Close to the toll-bar are two furnaces, which have done their work, the mines being worked out, the process of demolition having proceeded to decapitation only. During their lifetime they run out a very large fortune to the proprietor, the late William Ward, Esq. We now proceed along this hollow road to Wolver-

hampton, hemmed in on all sides by Iron works and collieries, and as we near the latter town, the great Chillington works are seen on the right; on the left, on the banks of the canal, will be seen Edwin Lewis' gas tube factory; also, Bayliss, Jones & Bayliss's great works, the well-known contracting merchants, of 3, Crooked Lane, Cannon Street, London, for rails, fishing plates, nuts and bolts, and all kinds of Iron work, from massive cables and anchors to half-inch chains and small screws. Close on the left side of the bridge we have Mr. F. N. Clark's great galvanizing works, one of the largest in Wolverhampton. On the banks

of the canal to the right is Perks's famous old edge tool

Bayliss, Jones & Bayliss's works.

Mr. F. N. Clark's great galvanising Works.

works, and further on in consecutive succession, are the Iron works of G. B. Thorneycroft & Co., Mr. Isaac Jenks, the present Mayor's, Minerva, and Beaver Steel Works; Baldwin's & W. Sparrow's tin plate works; T. & C. Clark's famed foundry for the enamelled hollow ware, of which they are the original patentees; Mr. Thomas Bridge's foundry for the manufacture of all kinds of castings, machines, steam engines, &c., &c.; and farther on, the chemical laboratory of W. Bailey & Son, famed in London and elsewhere for the manufacture of mercurials and choice chemicals, more than any other establishment.1 Wolverhampton is a town of considerable antiquity, and has a fine old Gothic collegiate church. The grammar school here claims the honour of educating Dr. Johnson, also the famous Dr. Abernethy and Sir William Congreve. There are three Methodist chapels, one New Connection, one Primitive Methodist, two spacious and elegant Congregational churches, and a beautiful Baptist chapel. The ministers and clergymen of all denominations here are always of a higher and more educated class than other towns in the Midlands, not even excepting Birmingham. The late Angel James of Birmingham must be excepted. A large infirmary, a Government school of art, and an orphanage built by a private individual, which honours the memory of Mr. John Lee, and largely ministers to one of the first necessities of orphan children. This

<sup>&</sup>lt;sup>1</sup> Mr. Bailey is the patentee of the well-known bisulphite of lime, so justly celebrated for purifying brewers' casks, and preventing decomposition in butchers' meat, and makes the bisulphite at this laboratory.



is the great emporium for the manufacture of stock locks, rim, mortice and cabinet locks; indeed, most

kinds of the best house, door and cupboard locks, are made here. Chubb's great lock works have always been carried on at Wolverhampton; cut nails and corkscrews, edge tools and brass foundry, gas tubes and Iron hurdles, have long been made to a great extent here. The galvanizing trade was introduced here thirty-five years since by Mr. Edward Davies of the Crown Works, and has constantly increased with the demand, until both galvanizing and galvanized manufactures produced here have become very important Wolverhampton industries.

The wood engraving opposite represents Mr. Edward Davies's Crown Galvanizing Works. We believe Mr. Davies was the first to introduce galvanizing on a large scale into Wolverhampton, in 1838. The trade has

since become one of the principal staple trades of the town. Nevertheless, Mr. Davies's article has always kept a very high position in the market. The brand of the Crown Works is a crown surmounting the Staffordshire knot.



His best Crown sheets have always been well known and appreciated in the market, and occupy the very highest position in the United States of America and Australia.

Mr. Davies likewise galvanizes best best, and high-class charcoal sheets. Iron is also tinned for various purposes. Galvanized Iron houses for export are made largely at Mr. Davies's factory, which is well situated both for canal and railway accommodation.

The japannery of Wolverhampton is the best in England. Mr. F. Walton's articles, produced at the Old Hall, for artistic design, elegance of shape, and excellency of workmanship, supersede all others in the United Kingdom; there are three or four other very large concerns, all producing first-class goods in their own peculiar styles; the largest and most important of these, and the greatest favourite in the London market, is Mr. Henry Loveridge, late Shoolbred and Loveridge's. the japanners carry on the tin plate workings. tin plate workers of Wolverhampton are likewise in very high esteem in the London market. The factors and merchants of Wolverhampton are a very important and influential class; Mr. John Morton's being the largest and most important concern of them all, for all kinds of Iron manufactures and Iron itself. The largest stock of Iron out of London is always kept here, at the great Iron warehouse of G. & W. Underhill, in Castle Street, and an astonishing business in extent is done by this firm. Certainly the largest of any Iron merchants out of London, it is the oldest concern in the Black Country, and was established by Mr. Joseph Underhill, the father of the present proprietors, at the beginning of this century. This firm, for sixty years, have been the agents for the sale of the S.C. crown Iron made by Mr. Foster, of Stourbridge, the old name of John Bradley and Co. still being kept up.

Wolverhampton returns two members to Parliament since 1832, always in the Liberal interest. At the last election we contested this borough in the Liberal interest against Mr. Weguelin and Mr. Staveley Hill.

Mr. Weguelin, the present sitting member, was the successful candidate. The Ironmasters meet here on Change every Wednesday afternoon, and the Wolverhampton quarter day takes place the second Wednesday in each quarter of the year. One side of the town develops to view the Black Country in earnest, the other presents a beautiful landscape, with the charming country village of Tettenhall, two miles distant from the town.

### WOLVERHAMPTON

cannot boast of street architecture to compare with New Street, Birmingham, or Sackville Street, Dublin.

The Queen Street Church, however, and one of the Methodist chapels, for architectual beauty and design, will sustain favourable comparison with anything of the kind in England. The old Gothic Collegiate Church is a fine specimen worthy of the attention of the

archæologist.

The other public buildings are the Iron Exchange and Town Hall: the facade of the latter is good Italian, the former a good building, but damaged by its proximity to the Collegiate Church. There is likewise a handsome school of art, and a noble infirmary. The design of the latter is bold, imposing, and effective, but devoid of all trapping and embellishments as it should be in the execution. Wolverhampton, likewise, has a splendid orphan home as good in the design of the building as it is benevolent in its object. G. & W. Underhill's monster warehouse and Henry Loveridge's Japan Works are buildings well worth seeing; the stock of Iron at the former, and the number of hands and activity in japan work at the latter, surpass anything of the kind in the United Kingdom. Wolverhampton is well supplied with banks. The Bilston District and the Wolverhampton and Staffordshire are the oldest, and do the largest business. The Midland Limited and Lloyds' Banking Company of Birmingham also have banking houses here. The merchants, factors, and tradesmen of Wolverhampton are noted for punctuality in the payment of accounts : in this respect Wolverhampton stands higher than any town in England, the cotton Lords of Manchester excepted.

96 TIPTON.

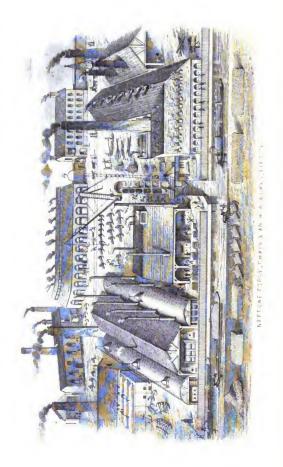
# THE NEPTUNE FORGE CHAIN AND ANCHOR WORKS, TIPTON GREEN, TIPTON.

This is one of the largest chain and anchor works in England, well represented by plate opposite.

The situation is admirable, being on the banks of the canal, near to the railway and in the very centre of the coal and labour market. Mr. Joseph Wright, the proprietor, is the son-in-law of Mr. Theophilus Tinsley, the well known nail factor of Dudley, and we believe the Tildsley family are still connected with these great works. Mr. Wright's chains are famous not only in the London and Liverpool markets, but throughout the world: the cables made at this celebrated forge stand unrivalled. When in the Black Country the other day, we were particular in our enquiries in respect to Wright's chains and cables at the Government testing and proof establishment at Tipton, and were there informed that the testing and proving of the cables and chains turned out at the Neptune forge completely justified the celebrity for quality which Mr. Wright's chains have in Germany, Russia, the Levant, and other foreign markets. The anchors made here are well known throughout the world, the Neptune forge having turned out from time to time the best and largest made. We understand the excellency of the 'quality of the chains and cables is owing in a great measure to the use of B.B.H., and the Earl of Dudley's bars, which are

LENOX AND

# TELEGRAPH MESSAGES SHOULD BE SENT TO DUDLEY RAILWAY STATION.



unsparingly consumed at this great factory, although the price paid is 1*l*. per ton to 1*l*. 12*s*. 6*d*. per ton more than any other Iron of this class made in Staffordshire. Messrs. Wright & Co. are now engaged on large orders for the Russian and Turkish Governments.

The Coalbrookdale Company is very nearly as old as the Carron Foundry in Scotland. wonderful and time-honoured establishment. As everyone knows the name of Coalbrook Dale, from the prince to the peasant, the merchant to the artisan, as well as bankers, stockbrokers, and even the more secluded sacerdotal element of the various religious hierarchies, from Pio Nono down to the most humble Scripture reader in London, all these are familiar with the name of Coalbrook Dale, appreciate the productions of its foundries, and acknowledge that the make and brand of this eminent old firm is a guarantee for strength and usefulness, good Iron, good workmanship, and the absence of parsimonious trickery, either in metal or workmanship, in any article they produce. The Coalbrook Dale Company have five blast furnaces at Lawley, Light Moor, and Dawley Castle, and one large mill and forge at the Horse Hay, where all kinds of Iron are made, from a rail bar to a wire rod. The Great Dale Works are situated in a lovely valley; the scenery around is charmingly beautiful, the rising slopes of the banks of the Severn, wooded as they are with trees and indigenous shrubs to the water's edge, create an effect upon the visitor as surprising as it is pleasing: we have seen nothing, either at the lakes of Cumberland or Geneva, on the Rhine or in Italy, to supersede this unique loveliness and natural beauty. Near to the Dale, on the opposite side of the Severn, the famous long smoking pipes are made, at Broseley: these comfortable pipes are well known in London and elsewhere as Broseleys. Lower down the Coal Port China Works are fixed on the banks of the Severn; here Rose's Coal Port China has been manufactured with success for a

century. At the Iron Bridge, named after the bridge which spans the river at this point, is a thriving little business town, supported exclusively by the artisans of the Dale factory, and the numerous Ironworkers in the immediate neighbourhood. A few miles distant The are the Madeley Wood Iron Works, the property of the Fletcher is Anstice family, for generations known and justly loved the in the neighbourhood; here are three blast furnaces. church-yard here. The Iron, deservedly in request for foundry purposes, always commands a high price, even for Shropshire. Near here, at Madeley, are the Madeley Court Works, the property of Mr. W. O. Foster, M.P., of Stourton Castle: all the Iron made here is sent by the proprie- spot that tors to Stourbridge and Brockmoor, and manufactured Fletcher's at those famous works into S. C. & Staffordshire bars; the plant here is modern and good, was erected with care, abreast with all modern improvements, regardless of expense, by the late Mr. J. Foster; the Ironstone and coal here are first class. The Old Park Works, and Sterchly, have been for more than a century in the Botfield family. Mr. Boriah succeeded the late Mr. William Botfield, at the death of his uncle. The latter, however, being now dead, the Old Park was worked by a limited company, which was superseded by the present proprietors, and the widow of the late Boriah Botfield, a month since, sold the Sterchly Works, with all leases, and other Iron interests in Shropshire, belonging to the Botfield estate, to the Heybridge Company, a young but enterprising firm, for £50,000, the managing partner of which had formerly held a confidential appointment at Malins-Lee Hall, where

sainted buried in

The Madelev Wood Works can be seen from the precious covers remains.

he will now, as principal director, conduct the works established more than a century on the late estate of T. & W. Botfield, one of the oldest Ironmaster families of Shropshire.

### THE LILLESHALL COAL AND IRON COMPANY

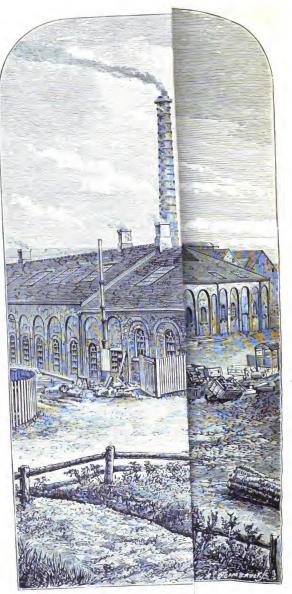
is on the Sutherland estates, situated an hour's drive from the market-town of Shiffnal, which has a railway station in the centre of it, the furnaces being only a short mile from the Oaken Gates railway station. Mr. T. Horton, the managing director, resides at Prior's Lee Hall, the most easy and agreeable approach to which is viâ Shiffnal with a carriage, through a beautiful country, the chief offices of the company being close to Prior's Lee Hall.

The Lilleshall Coal and Iron Company employ the largest number of men of any firm in Shropshire in the Lilleshall mines and collieries, and at the blast furnaces, and the great engine factory; and for many years, in point of magnitude and importance, have occupied, perhaps, the most important and prominent position of any concern in Shropshire. The firm produces pig Iron, hot and cold blast, famed for its quality throughout the world, and a large quantity of coal for the open market beyond that required to supply their own works; they likewise have large fire-brick works, and one of the most extensive and well-equipped engine shops in the kingdom, supplied with foundries, brass-casting shops,

<sup>&</sup>lt;sup>1</sup> Lilleshall pig Iron was found in the Emperor Theodore's Cannon Foundry in Magdala in Abyssinia on the advent of the English forces under Napier.

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and all kinds of machinery adapted to the manufacture of the largest steam-engines of all kinds. A large business is done here in locomotives for colliery purposes, and for this class of engine the Phœnix Foundry has for a long time rivalled the engine shops of Manchester and the Tyne. Here the well-known patent Dawe's steam compound engines, fitted with Holt's expansion gear, are made, and the Phœnix steam hammer, designed and erected by the company, appears to have been extensively adopted at various Iron-making centres. The success of this great factory, and the general approbation accorded to its productions, may, no doubt, be attributed in some degree to the quality of the Iron, none but Lilleshall pig Iron being used at these foundries, the comparative superiority in the strength of which is admitted on all hands.

In the next place, the tools and machinery of every kind for turning, planing, slotting, drilling, punching, &c., is quite abreast with the Clyde, Manchester and the Tyne; being near, likewise, to the Sneds hill Iron Works, a ready supply of best plates and bars for the boiler yards and smiths' shops, the best malleable Iron is always at hand, and used in everything made at the factory. The Phœnix engine shops are principally employed on portable and large engines and the heavy machinery used in Iron works; some of the best blast engines in the United Kingdom have been turned out at this establishment, and if we take into account the extent and perfection of the machinery, the superior quality of the Iron, and the high class of mechanics employed here, the celebrity of the

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apply with best pigs the Snedshill Co. and Bar Iron Co.'s Works, and the makers of the class Staffordshire brands of finished Iron. ows & Sons of Bloomfield, B. B. H. Brand in hire, consume this best Iron more extensively other house in Staffordshire.

are two distinct blast furnace establishments. at Prior's Lee, four in a row, which were a few years since on the most modern plan, ery appliance to save labour and to continue out of the old Lilleshall brand. The blast engines made by the company, and are a beautiful bright condensers with ample power, and do dory duty without accident. The hot-blast is perfect, the gas ministering without trouble generation of caloric, both for steam boilers and ovens, the latter being constructed on a new cople, which gives heated blast with increased nomy to any temperature required. The richness the ore facilitates a large make of Iron at each Inace, with a lower temperature of the blast than is nerally injected at the furnaces of Middlesboro' or totland. In looking over this plant we were struck lost by various elements of success in the construction the works.

First. The admirable selection, ab initio, of the site m which the furnaces stand, the coal and mines being delivered from a higher level, which saves labour and renders the large supplies of material more easy, the same advantages apply to the deliveries of the metal by trucks to the railway, the pig-beds being near to the main line, which carries the metal on the

rails by the Company's own locomotives on to the main line. The level of the pig-beds gives all that can be desired in gradient to save traction power, and consequently expense. The general arrangements and management are perfect.

Our attention was particularly directed to a patent mine stone-breaker which broke the mine, admirably crushing the largest lumps of limestone at one grip, reducing rock into proper-sized fragments for admixture with the materials for the furnaces. This patent machine, with its attendant steam-engine, is fixed at the proper level for the furnace.

### THE LILLESHALL COMPANY'S LODGE FURNACES.

We admire the Lilleshall Company's Prior's Lee furnaces, but we must give an extra mede of praise to the five famous furnaces at the Lodge, which are situated on a lovely spot on the estate. We need not describe them, sufficient to say, in situation, construction, erection, and all machinery they are perfection itself, and if the reader will examine the engraving at the beginning of the Guide, he will be able to trace the perfect lines of the works which dominate the whole, from the splendid pair of bright Lilleshall made blast engines, to the most minute erection in this famed establishment. These works are a picture. We were struck with admiration at the effective simplicity of the machinery which supplies the calcining kilns with oil by an incline

<sup>&</sup>lt;sup>1</sup> By H. R. Marsden, and was made at the celebrated Soho Foundry, Leeds, on his patent plan so generally in use now.

tramway, worked by steam, and which will be seen at the left hand of the engraving; the calcining kilns will be seen behind, having the appearance of small duplicate furnaces. These kilns succeed admirably, and with their concomitant feeding apparatus are well worthy of an inspection at the cost of a long journey, the saving of manual labour in this department is marvellous-locomotive engines are employed in all departments, removing the slag right away from the furnaces and take the pigs straight to the railway. Limestone, Ironstone and fuel is supplied to the kilns and furnaces by the same motive power. That, however, which is most to be admired here, is the quality of Lilleshall cold blast Iron turned out at the Lodge Furnaces. In quality it stands alone without a rival, and forms the back-bone of strength in all metal mixtures and every engine shop and foundry of eminence in the United Kingdom. For strength and resistance to torsion strain there is nothing produced like it. This is a fact admitted and acknowledged by our most eminent engineers: where strength is required in a casting used in the most costly machinery Lilleshall cold blast pig is a sine qua non. A good chilled roll cannot be made without it, and there can be no doubt that the celebrity of the Phœnix Foundry, and the malleable Iron made at the Snedshill works, and the well known B.B.H. brand in Staffordshire, is in a great measure owing to the large quantity of the Lilleshall Company's cold blast Iron used at these three establishments.

The Kettley Company, one blast furnace only, twenty puddling furnaces, with mills and forges, one of

the oldest concerns in Shropshire, make a very good Iron; and are known in the market for the quality of their bars, hoops, and wire rods. Mr. John Williams, the present managing partner's father, was always loved and esteemed by the workpeople and the whole of Mr. Williams walks in the footsteps of his Kettlev. father in this respect, and lives out in his life all the traits of a kind, unostentatious, benevolent, and true Shropshire gentleman. The late Gabriel Williams, the engineer, of whom we shall have something to say hereafter, graduated at these works in the last century. The Snedshill Bar Iron Company is the largest manufactory of malleable Iron in Shropshire, and for plates, wire rods, and hoops, has an unrivalled reputation These works were erected and established by Mr. Samuel Horton and Mr. William Simms; the former was brother to the late Mr. John Horton, of Prior's Lee Hall; the latter learnt his trade under Mr. James Foster, of Stourbridge, and came down as manager to one of Mr. Botfield's works, at Sterchley, subsequently joined the above gentleman, their united efforts created this extensive and successful establishment, which has contributed so much to the fame of Shropshire plates and wire rods. They have thirty-five puddling furnaces, and eight charcoal fires, with numerous mills, consuming mostly Lilleshall pig Iron, the quality of which with Mr. Horton's management has contributed more to the success and celebrity of the produce of these works than any other circum-The Snedshill plates are justly famed in the engine shops of Europe, and will bear testing with any

in the market. They are certainly equal to any plates made in Staffordshire or Shropshire, and far superior to any except one or two highly famed houses, and we should certainly prefer them to most brands known to us. The Snedshill Works were for many years carried on by Horton, Simms and Bull.

The reader may think we have written enthusiastically in describing the social attributes of the Shropshire Ironmaster: nothing of the kind. We knew them all, except the late Mr. Darby, in business, personally; having often had interviews with Mr. William Botfield, of Malinslee and Decker Hill, of whom it might truly be said that he was always a hospitable gentleman, at the latter, and a thorough business man, with great decision, at the former. Of all the counties in England Shropshire is the most noted for unostentatious hospitality, open-hearted kindness, and straightforwardness; these old worthies were a striking type of the genuine Shropshire character, eschewing the outward garnishments and traditional consequence of the proud Salopians, which are often observable at the fine old county town of Shrewsbury, and no doubt the finest and most perfect type of these old Shropshire Ironmasters was the late and ever lamented Mr. John Horton of Prior's Lee Hall, whose nobleness of nature, kindness and goodheartednes, endeared him to all who knew him.

Last, though by no means least important, in this district, is the Lilleshall Coal and Iron Company, which has nine blast furnaces, extensive engine shops, and foundries, &c., notable for the quantity of Iron produced, the quality when made, and the large number

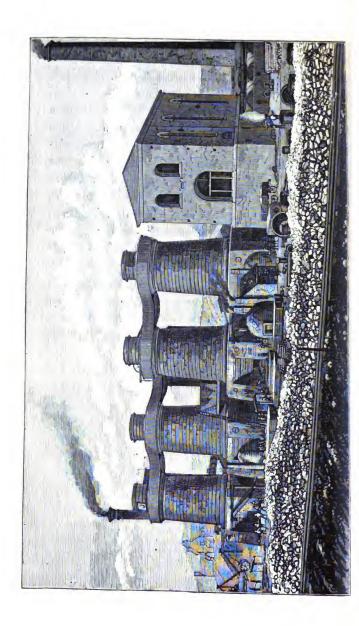
Mr. George Jones took with him into Staffordshire a profound knowledge of coal mines, which was turned to practical and profitable

of men employed in their extensive mines, collieries, and other departments, that we have given a separate notice of this far-famed establishment. cluding this chapter on Shropshire, it is remarkable to notice that, except at Coalbrook Dale, our friends in Shropshire, as compared with Staffordshire, Glasgow, and the young and rising district of Middlesborough, have always been slow in developing metallurgical industries; the district, up to the present time, being without any of those great hives of industry in the hardware trades (the Dale always excepted) which characterize the districts above referred to. Shropshire men have shown but little inclination to migrate to other districts, the Baldwin family, of Staffordshire and Worcestershire, the Bagnalls of Gold's Hill, and the Jones's, of Shakerly, being the only families of note who emigrated and established themselves in the Iron and tin trades, in the above districts. The workmen through the whole district are quiet, orderly, intelligent, and industrious, loyal to their masters, strikes or disagreements being rarely heard of; the men in this district have always appreciated the paternal treatment of the masters, and work harmoniously with them; we only recollect one strike, which took place at the Snedshill works, in Horton, Simms and Bull's time, about twenty years since. The principal towns proper in Salopian Black Country are Madeley, the Iron Bridge, to the south; Dawley and Dawley Green, in the centre; and Kettley and Oakengates, in the north; the latter market on a Saturday evening is a singularly

busy and interesting one. Wesleyan Methodism prevails to the largest extent in this district. Madeley, Iron Bridge, Dawley and Oakengates, can boast of many large, handsome chapels, for the use of the followers of the sainted Wesley. Nonconformist places of worship abound in the district, and numerous Independents, Baptists, Primitive Methodists, and a few Brethren are to be found among the sturdy, stalwart, honest, Ironworkers of Shropshire. The township of Wellington is situated at the foot of the Wrekin, from the top of which the smoke and flaring blaze of the puddling blast furnaces may be seen by Londoners with peculiarly impressive effect, after dark at night Persons desiring to see this district may descend from the train at Shiffnal; an hour's drive through a lovely country will bring them on to the Lilleshall estate, indicated by a high chimney on the right, in the rear of Prior's Lee Hall, the residence of Mr. Thomas Horton, the managing partner of this Company. The engraving on next page will give an excellent idea of these magnificent works.

# COLLEY & Co.'s SCREWS AND BOXES.

Our friends on the Tyne and the Clyde have been enabled to compete with the Black Country in steamengines and ordinary castings for Ironworks. There are, however, certain specialities which will always be sought for in Staffordshire, simply because there they produce the best; hence, all projectors and proprietors of new works get their fire-bricks from Stour-



bridge, their chilled and soft rolls, the wrought Iron screws and boxes, and lifting jacks, from the Black Country, where the manufacture is understood, and the article can be used without fear of accident. Messrs. Colley & Co., of the Hope Works, West Bromwich, are amongst the oldest, and certainly are very good, makers of lifting jacks, screws, and boxes. We have often seen their large screws at work at our own works at Greatbridge. We believe there are none made to excel them; we should feel confidence in sending screws for a large plate mill to Russia of Colley & Co.'s make. They not only understand how to cut them, but we know they are particular in the selection of the Iron used in the manufacture of both pins and boxes, and we all know the importance of an accident to a screw or a box. The mill cannot move until it is replaced, and it has frequently happened that mills abroad have remained idle until one could be got from England.

The testimonials published in the *Guide* from houses like John Bagnall & Sons, the New British Iron Company, and Samuel Beale & Co., of Rotherham, bear out all our own sense of justice to a firm like Colley & Co., whose boxes and screws we have used ourselves at the Greatbridge Works.

## CHAPTER X.

### NORTH STAFFORDSHIRE

# (ROBERT HEATH & SONS)

Is thirty-six miles distant from Wolverhampton, and has already played a very important part, during the last few years, in Iron making, and is, without doubt, one of the most rising Iron centres in the country. Messrs. Kinnersley were Bankers, and Iron merchants, at Newcastle-under-Lyne. In that capacity, having advanced money upon some mineral property at Kidsgrove, ultimately purchased the Clough Hall estate there, under the advice of the late Mr. Robert Heath. It was soon after discovered that the same estate overlay rich seams of coal. Mr. Heath opened collieries, and in a few years greatly increased the credit and riches of the bank, by the annual proceeds, strikingly exhibited in the balance sheets of the yearly sales of what Mr. Kinnersley was in the habit of calling his "black diamonds." These collieries, under Robert Heath's management, were a source of great profit, and no doubt the accumulation of wealth stimulated the extraordinary liberality in banking accommodation, which the Kinnersleys readily accorded to the master potters of Stoke, and Hanley, fifty years since; which, if it did not culminate in the end in large profits to the bank, materially assisted to establish

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7 large china concerns, to extend and consolidate ntroduction of the great china and earthenware afacturers in North Staffordshire, who, by their skill, uity and perseverance, have since raised their proons and created one of the staple export trades of puntry. Mr. Heath, sixty years since, commenced ng Iron at the new works, at Kidsgrove, which were rst of the kind in Staffordshire; these prospered, and nued to make money for the bank up to the time of eath. Mr. Robert Heath, junior, was brought up in the office, with his father: at the old gentleman's , the present Mr. Heath took to the management, was equally prosperous during his administration. ty years since, Mr. Heath commenced in the Iron himself, and has had the most prosperous course y single-handed Ironmaster in England.

bbert Heath & Son have the most extensive and able coal mines in North Staffordshire, and the ts of the far-seeing policy of Mr. Heath, during the ten years, must be marvellous, in the revenues now larly accruing on the annual balance sheet of their nsive concerns for, during the last ten years, while masters vacillated, through timidity caused by prices, Mr. Heath pursued a steady course of pursing and leasing coal and Ironstone properties, as ugh he clearly foresaw the good time coming, and ald be enabled, in 1872, when these extensive Iron coal mines were opened for a monster output, to both his Iron and coal at just double the price in Market. This was the case last year.

This firm was not led into heavy contracts, like the

Welsh rail makers, at the beginning of the year; on the contrary, their Iron, coal, and minerals were sold at the current prices, which, no doubt, made by far the most handsome return of any house in Staffordshire, or, perhaps in England (the Earl Dudley excepted). Robert Heath & Son have now, and worked all last year, the Biddulph, and Norton, and Ravensdale Iron Works, which have in all 154 puddling furnaces, with fourteen mills, and eight blast furnaces, at Biddulph, besides their extensive mines and collieries. The works are capable of making 1,600 tons of finished Iron per week, which, at the present average price would amount in value to about £1,257,000 per annum. The works are constructed on modern principles, and the hoops, bars, and plates made here stand high in the market, maintaining their ground with the best leading Staffordshire houses. We have devoted a little more space to this sketch, through a knowledge of the important fact, that whether in mines, or Iron manufacture, this is decidedly the largest concern, employing a greater number of men than any Iron-making firm in Staffordshire.

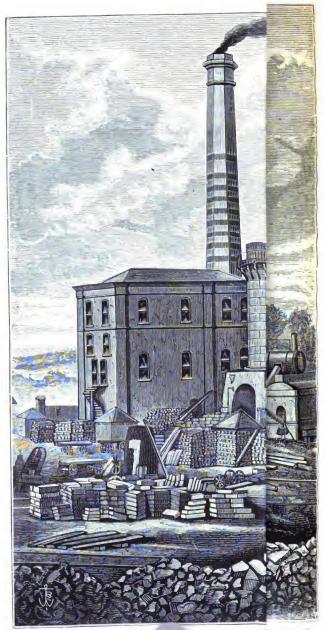
Mr. John H. Cocksedge is the London Agent. Offices: 90, Cannon Street, E.C.

The Great Shelton Bar Iron Company is situated at Handley, and is the property of the Right Honourable the Earl Granville, Lord Warden of the Cinque Ports, Her Majesty's Minister for Foreign Affairs, &c.

Mr. William Roden, M.P. for Stoke-upon-Trent, is

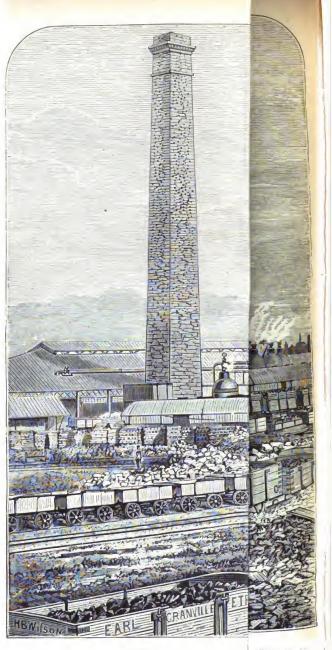
<sup>&</sup>lt;sup>1</sup> Robert Heath & Sons have at the Norton Works the best mills and machines for making anchors in Iron in England, and are capable of making angles of all sizes of the greatest lengths. For this class of Iron the firm has no rival in this country.

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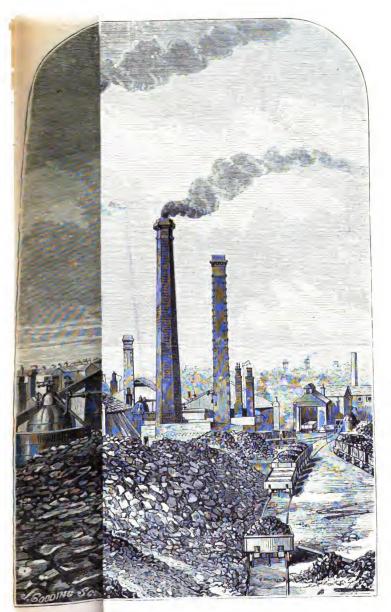


managing partner with his Lordship, in this extensive concern.

There are ninety-four puddling furnaces, seven mills, and eight blast furnaces, with extensive Iron mines and collieries. The works were laid down sixteen years since, under the direction of first-class engineers, and erected with assiduous care, quite regardless of expense. The Shelton Bar may therefore be truly called a model works. The noble Earl had worked the blast furnaces long before the Shelton Bar was established. Most of the pig Iron, during this period, had to be sent by rail to South Staffordshire, which occasionally turned out a very unsatisfactory market. Mr. Frederick Wragge for a long period has acted as his Lordship's sole manager and chief agent in this department. The pig Iron made now is mostly consumed at the Shelton Bar, but as this company have for years been improving the quality and raising the celebrity of their bars, plates, and angles, large quantities of his Lordship's famous Lilleshall brand (the best forge pig Iron in Shropshire) are used at these works as a mixture; hæmatite pigs from the North, from the most famous makers there, to mix with the other brands above referred to, are all used to produce the splendid plates, for the production of which the Shelton Bar Company is so justly celebrated, at the yards on the Thames, the Clyde, and other ship-building centres in this country. The bars are of a very superior quality, and may fearlessly be compared with the produce of the leading houses in Staffordshire, the Iron being peculiarly suitable for the use of Railway Companies, engine shops, and machinists, in Manchester, and on the

Tyne. The works are adapted to make round squares of large diameters, plates as large and as as most houses in Staffordshire, the management ha by the addition of Lilleshall, the Barrow Steel and other pig Iron, succeeded in making a qu of malleable Iron, not in the least red short, a tiful light colour in the fracture, with a rich fi and which will stand a tensile strain in a much high degree than that of many other houses in Staffordshi The Right Hon. Earl Granville is the chief partn being associated with W. Roden, Esq., M.P., Thom Horton, Esq., of Prior's Lee Hall, and other gentleme. Mr. Roden is the managing partner of the Shelton Ba Company. The Cliff Vale railway station comes ver near to the works, or an easy advent is accomplished viâ Stoke-upon-Trent. Good cabs are obtained at the Railway Hotel, Stoke-upon-Trent, which is without exception the best hotel in the Potteries, the waiters being very obliging, and the landlady particularly anxious to make her guests comfortable.

The Shelton furnaces are the largest group together in North Staffordshire, containing eight in all. They belong exclusively to the noble Earl. His Lordship has extensive coal and iron mines here. The furnaces are very near to the Shelton Bar Company's works, and minister to a great extent to the supply of pig Iron of the Shelton Bar works, and other Staffordshire houses, who depend to some extent for the supply of the raw material on these furnaces. A very large number of men are employed here. As before stated, Frederick Wragge, Esq., is the manager and chief agent for his Lordship at this blast furnace establishment.



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## CHAPTER XI.

THE MIDDLESBOROUGH, OR CLEVELAND DISTRICT,

Has surpassed by far all the Iron centres in England and Scotland in the quantity produced last year, being no less than 1,968,972 tons, for 1872, of pig Iron, an increase on 1871 of 84,000 odd tons. The make of this district in 1854 was only 250,000 tons. The first item in these figures, which represents the make of 1872, speaks more conclusively than anything we can write in proof of the marvellous progress Cleveland has made, during the last nineteen years, in the quantity of pig Iron it produces; indeed the rapid progress made, and the extraordinary development of this district, in the interval above referred to, is a marvel to the trade generally, and we should think affords constant surprise to the Cleveland Ironmasters themselves. We must attribute this wonderful and rapid success in Iron making to three causes.

First, cheap Ironstone.

Second, favourable conditions for a supply of coal and coke at a cheap rate.

Third, facilities for shipping the Iron at a moderate freight to all parts of the world. The usual price of Ironstone, delivered at the furnaces, was only about original 3s. 6d. per ton. The coal was from the inexhaustible of Mine.

Large deposits of Iron Ore gotten at little

expense.

coal-fields of Durham and Northumberland, which were near, and cost, before the advance, as little or less than the most favoured districts. The shipping charges were much more favourable than Staffordshire, Shropshire, and Northamptonshire, from their inland position. We believe these triple advantages have assisted Cleveland, more than any other circumstances, to achieve the gigantic results in quantity referred to above, as the total make. It may be a little surprising to observe the original value of the ore delivered at the furnaces. This, however, is owing to the generous deposits of the metal in horizontal beds, which, in many cases, extend to a great thickness in the mountain ranges, and are frequently run out by an adit or drift from these beds on to the railway, which carries it to the furnaces. The mines generally are not deep, like Staffordshire or Lancashire; they mostly run with a three-foot seam of ore, which is left to form the roof, thus covering the main deposit, which is found six inches lower; this last runs from six to ten, and often fifteen feet thick. The nature of the mine, too, renders the extraction comparatively easy. The Royalties, too, are very low, say from fourpence to ninepence per ton. The men work by shifts, from 6 A.M. to 2 o'clock in the afternoon, and again from 6 in the evening to 2 o'clock the next morning. thought and believed that the Cleveland district contains 5,000,000,000,000 of tons of this ore, and that it may supply the district, making reasonable allowance for the probable increase of consumption, for about seventy years. The ore of Cleveland is not so rich in

Shift system of working the mine by the men.

The Iron Ore will last 70 years.

Iron as some other districts, it resembles very much in appearance and quality the great mine at the Seend Works in Wiltshire, or the Dustan Mine in Northamp- The two tonshire, but we have seen no mines in Cleveland largest deposits anything like equal, in the depth of the deposit, to we have either of those mentioned, both being of the greatest this kind depth, and most inexpensively extracted of any of the either in mines in either of these counties. Having inspected abroad. the whole of them, we can speak with confidence on this subject; one man at one shift, in Cleveland, will load up about six tons per shift of eight hours, and most mines employ two shifts. The plan of working here is in advance of other districts, and secures the greatest quantity of mine at the least expense. Three years since, the labour-cost of extraction was from 71d. to 10d. per ton; now the former is 1s. 4d., which raises the price of the ore to the masters, at the furnace Present mouth, to 8s. or 8s. 6d. per ton. The difference in cost of the character of the deposit here, renders the extraction easy and inexpensive, compared with the punching and blasting so necessary to disengage the hæmatites of Cumberland from the carboniferous limestone, into the fissures and pockets of which it was originally so mysteriously injected. The same remarks will apply, though not in the same degree, to the black band of Wales, and all other argillaceous Ironstones, so plentiful in Scotland and Staffordshire, the cost of getting the Flats, Robbins, and Balls, being a charter of no less than 10s. to 15s. per ton at Bilston at this moment. comparisons are intended to exhibit to those unacquainted with the Iron Trade, the great advantage which Cleve-

of ore. Englandor

land masters possess in the nature and position of the

Cleveland Ironstone, and that, which is of equal importance, their contiguity to the inexhaustible supplies of coal underlying the Durham and Northumberland districts, which, three or four years since, could be converted into coke, and delivered at the furnace mouth, in Cleveland, at prices very much lower than coke could be procured at the furnaces in any other district. Things are now The demand upon Northumberland and Durham for 32,000,000 of tons of coal and coke last year, has enabled the coal owners to double the price. Therefore, with the present price of coke at 40s. per ton, and Ironstone at 7s. 6d. per ton, the masters will not be able to produce pig Iron now, at less than 86s, per ton, with all the great advantages Cleveland enjoys from fuel, mine, and her seaboard. It is a fact that should be stated, that the Cleveland Ironmasters never use raw coal in the blast furnaces, but invariably coke; on the contrary, Scotland, Wales, Staffordshire, and Shropshire do so to a very large extent.

Increased cost of making Iron.

Coal doubled in price.

The importance, however, of Iron-making here, will be more fully realised by the reader, when we state that 14,000,000 of tons of coke and coal, Ironstone and limestone, must have been carried to, and consumed by, the blast furnaces, to produce 1,968,972 tons of pig Iron, which again was removed to the puddling furnaces, foundries, and shipping ports. Besides the enormous value of the Iron produced, the freights and

reasons are obvious, arising out of the different qualities of the fuel used in this and other districts; but space forbids our going further into it in this chapter.

charges for moving the mines and the metal must form an aggregate amount astounding to those not acquainted with the trade, and circulate a weekly sum for distribution in these districts greater perhaps than any other known to us. Although the price of Iron has so considerably advanced during the bewildering prosperity of last year, it is correctly stated, and we think the fact may be relied on, that the Cleveland Ironmasters have not made profits commensurate with The Ironthe doubled price of the metal. The masters in this make undistrict, under the influence of the languid demand fortunate sales of pig and low prices of 1867, 1868, and 1869, and other Iron in 1871, disturbing political elements ahead, entered into large which in contracts in the closing months of 1871 and the early went right part of 1872 at low prices, which took them right 1872. through 1872; and, in many cases, half the make of 1873 was sold, leaving the makers bound to deliveries which precluded them from the advantages of the high prices which ruled in the middle of last year; and although the Conciliation Board, with Mr. Rupert Kettle's assistance, has worked well with the Ironworkers, the vexatious conduct of the miners must have been a prolific source of loss and anxiety to the leading smelters of Cleveland, during the greater part of 1872. The manufacture of malleable Iron has become a great staple trade here, and may almost be said to run, pari passu, with pig Iron making. There are in the district upwards of 2,000 puddling furnaces, and corresponding reheating furnaces; the largest works are those of the Consett Company, Weardale Company, and Bolckow and Vaughan's, on the Tees; besides these,

some cases through

Samuelson's model works there are numerous other large manufactories, among which may be mentioned Messrs. Samuelson's, recently converted into a Limited Company, the machinery of which is considered perfect, being erected replete with all modern aids and improvements. Bolckow and Vaughan's, too, are admirably adapted and equipped, with reversing gear to the plate mills, and, on this account, can turn out prodigious quantities of heavy plates in a single turn. The rail mills, at all these great works, are well constructed, enabling the makers here to produce rails with as much facility as the oldest districts.

In the beginning of this great Cleveland industry, the puddlers and Ironworkers were principally imported from Staffordshire, and, up to this time, the puddlers watch the prices in the old Black Country, and appeal to this standard as a rule for their own. There are large foundries here, cut nails and the light and heavy casting trades appear to flourish; but the manufacture of tin plates, japannery, and general tin plate goods, has not taken root here yet, and as the Iron produced here is not adapted <sup>1</sup> for tin plates or

¹ These remarks must not apply to the Weardale Company; the Weardale Iron is without doubt by far the best made in the Cleveland District, ranking in its market value with the very best Staffordshire makes. This old and highly respectable concern, having the most valuable spathic Iron ores in England, admirably adapted for smelting into Spiegeleisen, and which, combined with a peculiar hematite deposit, possessed only by this Company, makes the very highest class of Iron for all purposes, and we believe would make Tray Iron and Black Plate superior to any made even in Staffordshire itself. The Weardale Company have 6 blast furnaces, 60 puddling furnaces, besides reheating furnaces, rolling mills, and four 2½-ton Bessemer converters. With the exception of the Ebbw Vale Company, this is the only firm in England able to make Spiegeleisen from their own spathic ores, which are without doubt the most valuable in England.

trays, probably Cleveland may never rival, in its manufactures, the famous japanners and tin plate workers of Wolverhampton and Birmingham.

The title of the Company is the 'Weardale Iron and Coal Company,' Limited.

They have mines of Iron ore in 'Weardale' which they are working, and smelting at Tow Law near Darlington (where they have four blast furnaces, two of which are out of blast, being under repair and enlargement). These ores, being deposits of spathic carbonate of Iron (more or less) where near the surface, spontaneously decomposed into hydrated per-oxide of Iron, and they yield, as is known to all metallurgical authorities, Iron of a quality which is not surpassed by the best of English or foreign ores. The steel that is made of this Iron is not equalled by any other made in Britain.

They have also two blast furnaces as well as rolling mills at Tudhoe near Ferry Hill. The blast furnaces working partly upon 'Weardale' and Cleveland ores obtained from extensive mines which they hold in the neighbourhood of Guisborough.

The Company have extensive coal mines both at Tow Law and at Tudhoe which are worked for their own consumption, and also for sale, chiefly in the form of coke, for the use of other Iron works.

They make steel rails, tyres, and other important steel and Iron forgings on a large scale. The quality of the Iron and steel they produce, and the high standing of the firm, gives their brand a commanding position in the general market, which generally affords them a good supply of orders even in flat seasons of the trade, when other houses, less fortunate in the above respects, suffer from the paucity of orders. Their brand is TUDHOE \$\psi\$. They have an extensive wharf and warehouse on the Thames.—Mr. Robert Troubridge, London Manager. This old firm makes bars and every other kind of Iron.

### CHAPTER XII.

#### BOLCKOW AND VAUGHAN.

WE must not leave Middlesborough without referring at least to one concern in particular which has done so much by liberality and example to establish Middlesborough as the largest Iron-making centre in England. In 1838 Bolckow and Vaughan commenced in Middlesborough to manufacture bars. The difficulty in obtaining suitable pig Iron for their foundries which were first established, drove Mr. Vaughan to think of establishing blast furnaces. In this dilemma, Cleveland for mines was judiciously fixed upon under lease from the trustees of Lady Hewley's Charity of the Eston Royalties. So earnest and determined was Mr. Vaughan to succeed in this new undertaking, that he projected a new line of railway to bridge the difficulty which distance of Eston from the works presented, and although it was only commenced in October, the line was triumphantly opened for traffic on the following 6th of January, 1851. Mr. Vaughan's modest estimate of the mines was 1,000 tons per week. The first year, however, more than three times this amount was turned out. The Eston mines have steadily progressed in their out-put with the Cleveland district, and to-day they yield 2,500 tons per diem. The next step was the blast furnaces at Wilton Park (one recently erected makes

five here). Mr. Thomas Vaughan must have the credit of introducing high furnaces of large dimensions into Cleveland, which are now generally adopted in the district. At one furnace at Witton Park, 400 tons of Bessemer Iron is being made per week, the ore being imported from Spain and Whitehaven. Messrs. Bolckow and Vaughan's celebrity, however, is derived more from their extensive manufacture of malleable Iron. They have 110 puddling furnaces, and made in 1852 at these works 56,000 tons of plates, rails, and other kinds of finished Iron. Their machinery for large plates and rails is perfect, and the Middlesborough Works are well adapted to long angles of all sizes. They have eight mills in operation, and ten steamhammers. Taking Eston, Witton, and Middlesborough together, these works are a credit to Mr. Vaughan, the designer, and an honour to the great Cleveland district, which can so justly boast of some of the most able and scientific Ironmasters in the United Kingdom.

This great company is merged into a Limited Company, and is eminently successful in paying large dividends. The shares to-day are quoted in the 'London Iron Trade Exchange' at 60l. each, 35l. only being paid up. We attribute in some measure, the success of this company, to the judicious expenditure of money in the original erection of the works; mainly, to Mr. Vaughan's management, and their wonderful mining property. We believe the original proprietors still have the largest interest by far in the concern, and give their able assistance to the management.

# CHAPTER XIII.

#### NORTHAMPTONSHIRE IRON DISTRICT.

NORTHAMPTONSHIRE, during the last fifteen years, has become a very important district for Iron ore; it likewise has, at the present time, twelve blast furnaces, two of which are idle; the Butlin Company being the largest, with four blast furnaces. Northamptonshire last year made 70,500 tons of pig Iron, and raised 1,000,000 tons of Iron ore. The best mines here are the Dustan and the Gayton, the former being almost inexhaustible for quantity, and the latter the best quality in the county; being sound, solid rock, from ten to twenty feet thick, extending under Gayton church and churchyard. Both Dustan and Gayton belong to George Pell, Esq., of Heyford; besides these there are Dean and Chapter, Glendon and Findon, Willenboro', Blisworth, Newbridge, Castle-Dykes, Stonepit Close, East End, Woodford Islip, and King Sutton. The ore raised last year was distributed by rail between South Wales and the Forest of Dean, South Staffordshire (the largest portion), Derbyshire, Yorkshire, and Worces-The ore here is of the oolite kind, and is tershire. found only a few feet or yards from the surface, in loose deposits, except at Gayton, where it is a kind of rock band of splendid quality: we have often inspected mines in this district.

Stinson's Malleable Iron Works, at Northampton, make good malleable Iron, which fetches very high prices; and another malleable Iron works is in course of erection. Most of the pig Iron exported from Northamptonshire is consumed in the South Staffordshire district: the Ironmasters' names will be found in the Tabular List. All the coal used here is brought from Derbyshire and Staffordshire, and the coke from Durham. When we carried on blast furnaces in this county our supply for all the furnaces we obtained from the Earl of Dudley's collieries, in Staffordshire, which carried a good burden, and worked well with this ore. The Heyford furnaces will be observed close to the North Western railway, two miles on the London side of Weedon: there are three furnaces here, now worked by Mr. Plevins; the Iron made stands well in the Staffordshire market, which is accessible to the works both by rail and canal. The furnaces are fed with ore by the celebrated Gayton and Duston mines. We must observe that coal has not yet been found in Northamptonshire. An attempt was made thirty or forty years since, by sinking a shaft very near to Northampton a considerable depth. laudable effort was abandoned, although with our present geological knowledge, the indications of this sinking would not be considered unfavourable to the hypothesis of coal beds below. If coal should be hereafter discovered underlying the Iron deposits here, Northamptonshire may yet become one of the most favoured and successful Iron producing counties in England. We believe coal does exist here.

## CHAPTER XIV.

#### WHITEHAVEN DISTRICT.

The Whitehaven District is on the borders of West Cumberland, about thirty miles from Barrow, and contains about thirty-six blast furnaces; the Cleator Moor and Workington having six furnaces each, being the most famed for quality in the Frizzingdon district. The Dutton furnace, belonging to Harrison, Ainsley & Co. is the oldest. Most of these proprietors have valuable hæmatite mines at Millom and Frizzingdon, where the best mines in West Cumberland are found; among which we may mention the Salter and Eskatt Park, which is far superior in its revenue to any gold mine. Mr. Thomas Browne, managing director from its commencement.

We have often felt relieved to find our advent accomplished at Whitehaven railway station. This railway is the property of the Barrow Steel Co. The last thirty or forty miles from Carnforth traverses the hæmatite district, being over a monotonous country, which soon convinces the traveller that the traffic in minerals and pigs is of no ordinary kind, and must of necessity require great care and expense to keep the railway in efficient working order. The Millom mines and furnaces on the left, and nearer still, the College of St. Bees, the latter educating, the former

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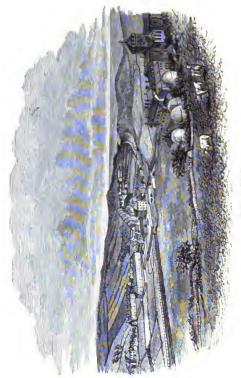
THE PORT OF WHITEHAVEN.
The two Shafts or Chimneys right and left of the Port are connected with the Engines which work
Lord Lond Londales Fits for miles under the Sec.

being a practical illustration of the development of the power of human intelligence over inanimate matter -are the first real indications to the traveller of an early advent to Whitehaven; omnibuses meet the trains from London. Mrs. Moat's Globe Hotel is comfortable and well-managed, and, for a visitor, the best in Whitehaven. Private rooms and beds all that could be desired, 'ménage' of the very best quality, served up with quiet and genteel propriety. Although the amiable hostess is not often seen, her watchful management is felt, in the prompt acknowledgment of the sound of the bell, and all other domestic ministrations in this homely establishment. Horses and carriages always ready at the shortest notice, the coachmen are well up in the district, and can tell you the name and fame of all the mines in the distance, as you drive over the fissures and pockets in this mountain limestone formation, into which the precious metal was injected from lower deposits in remote and early ages. How this strong solution of hæmatite ore found its way ab initio into the lower strata of the earth's crust must be left for geologists and natural philosophers to explain, being unable ourselves to penetrate farther into the arcanum in arcano of nature, with the view of discovering how the ore was consolidated? How long since the injection? and the various causes which cemented it together in unum corpus, at the point of contact of the metal with the walls of limestone, which sustained the solution of Iron before the heat of the crust of the earth upon the metal evaporated the water in solution, leaving the

residuum what it really is-Whitehaven hæmatite ore, in a hard rocky state, of superior quality, except the Parks Pocket, belonging to the Steel Company at Barrow. The 'Black Lion' is likewise a very estimable hotel, well managed, its guests looked after with paternal care. This hotel is frequented much by commercial travellers, a good smoking-room, where the wealthy mineral lords of Whitehaven smoke their pipes for an hour in the evening, discuss politics, converse on sensible subjects, invariably eschewing town scandal, sedulously avoiding the shop altogether. This select company are always pleased with the landlord's presence, in this very agreeable smokingroom. Very different is this to the small talk and ignorant twaddle generally the concomitants of suburban places of the same kind about London. The first thing that strikes a stranger at Whitehaven is a lucrative old colliery, the property of the noble Lord Lonsdale, which enriches the noble proprietor with the black diamonds, brought by gate-roads from beneath the nethermost depths of the sea, the workings extending to a considerable distance under the watery element at low tide. Most of the coal here belongs to Lord Lonsdale, who turns out about 250,000 tons a year; these, like the Earl of Dudley's collieries, return a princely revenue from the Iron consumers of this district. His Lordship's agency has always been liberally and well conducted, particularly during the recent coal famine, on the live and let live principle, and as his Lordship's coal is a 'sine quâ non' for the success of the Iron works, too much credit cannot be given to Lord

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Lonsdale's local administration on this behalf. The present agent is R. Alleyne Robinson, Esq., who is deservedly popular with all classes. The best minesare held by native proprietors, who quietly receive their enormous revenues without ostentatious boasting. Invariably the proprietors understand mining operations, and although regular managers are connected with the mines, the proprietors themselves are to be seen leaving Whitehaven by early morning trains for the various mines, which minister so materially to the wealth and prosperity of Whitehaven. The Cleator Moor, Workington, Harrington, Maryport, and Millom Iron Works, are the most important in this district, all ministered to by hæmatite mines of almost priceless value.

About this time last year we were instructed onbehalf of some wealthy clients of ours in the Iron tradeto give a fabulous sum for one of these mines, which was rejected, and the proprietors have reason to be thankful that they refused the tempting offer. A list of all the Iron works will be found in the proper place of the 'Guide,' and with regard to these wonderful mines we present all the best of them in a list, and although we must not particularise their relative values, which are well known to us, the consecutive order in which we have placed them may give the reader some idea of their value relatively. Taking these twenty mines as a whole, the value of their output surpasses that of any other district, except Barrow-in-Furness, we are acquainted with, far superseding in revenue the diamond mines of

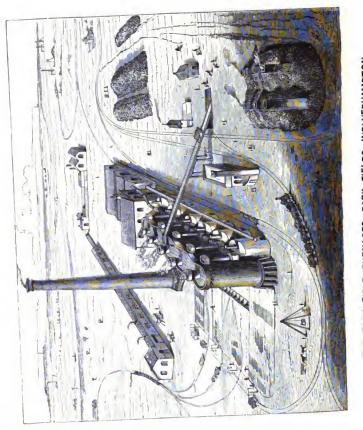
<sup>&</sup>lt;sup>1</sup> The Steel company's mines at Barrow, say the Parks Pocket and the Stank, are infinitely more valuable than anything at Frizzington being unrivalled by any mines in any country.

Golconda and the Cape, the silver of Mexico, or the gold of Peru, Australia, and California. There is an Iron shipbuilding yard here, carried on by a company of Whitehaven gentlemen, which is well managed, and turns out good ships of small dimensions. There is a salubrious promenade, the base of which forms a breakwater to the harbour. A stroll from this invigorating spot presents the sea fully to view, Lord Lonsdale's sea-coal pits, and the interesting seaboard of Whitehaven, with three Iron smelting furnaces carried on by the Lonsdale Company.

Further on up the seaboard are the great works of Bain and Patterson, at Harrington, and in succession higher up the seaboard are the Mossbay, the North of England, the West Cumberland, the Workington, the Maryport, Hæmatite Company, and the Solway Company's blast furnaces, all busily engaged in making best Bessemer pig Iron. Lord Lonsdale's pits, the Wellington, and the William, are fixed on each side of this interesting harbour, the gate-roads extending for miles under the sea, whence his Lordship extracts very large quantities of coal, no doubt at a good profit. The noble proprietor of these submarine workings pays a royalty of 4d. per ton to the Crown for coal extracted from beneath the sea. The increased business at this little port entails the necessity of new dock accommodation, which is now being actively carried out, and it is thought that the docks already in course of construction will be inadequate to the increasing requirements of this little sea-port.

There are three banks here, the most important





being the Whitehaven Joint Stock Banking Company, managed by Peter Cameron, Esq., the most able and experienced bank manager in Cumberland. The dividends of this establishment always quadrate with the astuteness of the management.

#### THE PARKFIELD FURNACES

are situated at Parkfield, near Wolverhampton, being named after the ancient Park Hall Collegiate School, an old Catholic foundation in the immediate vicinity of this estate, distant one mile from Wolverhampton, and about the same from Bilston. These great works were originally erected by J. Underhill, who was subsequently joined by John Bishton. Since the death of Mr. Underhill, they had been worked by other proprietors up to '52, when the property was purchased by Mr. Edward Bagnall Dimmach, in co-partnership with Mr. Henry Martin, Mr. Dimmach's son-in-law.

Enlargements and additions have from time to time been made by the present firm. The furnaces are well served by their own locomotives, on their own roads, a siding into the Stour Valley Railway, and their own Iron roads to the canal wharf. There are five blast furnaces, a pair of splendid beam blast engines capable of driving all the furnaces.

These engines work on the expansive principle.

The arrangements for drawing off the gas here we have always considered the most perfect in Staffordshire. This was one of the first large concerns to

economise fuel in the reapplication of the gases, and Parkfield furnaces being the largest group in South Staffordshire, have for years attracted visitors to witness the successful manner in which Mr. Henry Martin utilises the gases. The mineral estate occupies a very large area, has walls all round encircling the valuable coal and Ironstone mines which underlie the Parkfield estate, the property of Henry Marten, Esq., Parkfield House. The Iron made here is grey forge, and although some cinder is used, is of good quality. The quality of the coal here gives Parkfield Iron a peculiar 'Bell Ringing 'sound on the 'Breaker,' and as it is an indispensable mixture for most kinds of manufactured Iron, the large output of these works is always readily sold in the district. The management being first class, the brand is always uniform, no doubt in a greater degree than any other brand of Iron of this class made in Staffordshire. Mr. Edward Bagnall Dimmach formerly carried on the great Pontypool works in Wales, and during this period served the honourable office of high sheriff of the county of Monmouth. Mr. Dimmach is a county magistrate both for Monmouth and Staffordshire.

### CHAPTER XV.

GLOUCESTERSHIRE, THE FOREST OF DEAN, WILTSHIRE,
AND HAMPSHIRE.

GLOUCESTERSHIRE has nine blast furnaces, the Cinderford at the Forest of Dean being the most famous, the property of Mr. Henry Crawshay, brother of Mr. R. Crawshay, of Cyfartha, in Wales. The Iron made here, being of brown hæmatite, is valuable for steel making, and in great request for tin plates. Gold Brothers are likewise making very good Iron at Soudley. Oakwood belongs to the Ebbw Vale Company, but is not in blast.

Wiltshire has seven blast furnaces. The Westbury Company make a fair quality of Iron, resembling the Northamptonshire four blast furnaces. Messrs. Malcolm 1 have three furnaces at Seend, with a large deposit of oolite Ironstone; perhaps the largest, most easily worked, and at the least expense, of any that we remember to have inspected; the Iron produced is of the Northamptonshire quality.

Hampshire has only one blast furnace, which is now idle.

Somersetshire has one likewise, at Ashton Vale which makes very good Iron, worked by the Ashton Vale Company.

<sup>&</sup>lt;sup>1</sup> The proprietary is changed here.

## THE HYDE IRON WORKS, ESTABLISHED BY THE FOLEYS.

Messrs. Lee & Bolton are the proprietors of the works represented in the annexed beautiful engraving, which are situated in a lovely valley about four miles from Stourbridge, and are certainly, with their surroundings, the most picturesque of any Ironworks in the United Kingdom. The history of these works will be as interesting to the readers of this chapter as the picture represented by our engraving is charmingly beautiful.

The Hyde Iron Works were erected and for many years carried on by the ancestors of the present noble family of the Foleys-and here we may say this family is noble in nature as well as by patent-title from the sovereign, and has a patent enshrined in the love and affection of the whole hearts of the inhabitants of the district for miles and miles around their territorial domain. As we stated above, the Hyde works were built and worked by their ancestors. At that time Iron-making was in its infancy—this country was far behind Sweden and Russia-we had not then learnt how to make Iron with coal. This was long before Mr. Abraham Darby, Mr. Rennolls, of Ketley, and Dud Dudley utilised coal for Iron-making; and although at this time nails were forged under the hammer in the neighbourhood of Gornal, Dudley, and Brierley Hill, all the slit nail-rods consumed in the country were imported from Russia, and the price paid for them was 36l. to 40l. per ton, simply because we could not slit them. It is true that Cort had invented rolling in 1792 or 1793, but it was



hire.



left for Foley to teach us how to make slit-rods. The difficulty was great; they tried at the Carron, then the first works of the day, but failed; they likewise tried at the Kirkstall Forge and other places: all failed. The appearance of the rod puzzled the best metallurgists of the day; they observed the ragged edges, but were lost when they attempted the modus operandi which gave long nail-rods, straight, evidently never cut when cold; and then came the question how it was possible to cut these long rods so thin, hot, without softening the shears. Here England, Scotland, and Wales failed and gave it up; and our ancestors continued to pay 40l. per ton for Russian nail-rods.

As we before stated, the Hyde works were thriving under the Foleys. One of the sons, who had been brought up in the works, evinced a great passion for improving the manipulations, particularly of smaller sizes of Iron, and, although the family were wealthy, was continually in the works almost night and day; and as he had acquired a thorough knowledge of music, practised much in his leisure hours on the violin, an instrument in which he excelled, it is said, more than any man in England. Young Foley intimated his desire to visit London, and, after bidding adieu to the family, left with his favourite fiddle-a splendid Sagitarius which belonged to his grandfather: this, we are told, is still preserved among the family heirlooms, and said to be worth 600 guineas. The young gentleman was lost sight of for nearly two years. His friends, although they knew how thoughtful and steady he was, began to feel alarmed for his safety-for it must not be forgotten that even London was a very different place then to what it is now. Few visitors from the country were allowed to sleep within the precincts of the city, and none were allowed to remain beyond a certain time, always fixed by the authorities.

One evening, about six o'clock, young Foley, careworn, copper-coloured, tired and travel-stained, arrived at the Hyde Works with his beloved fiddle in a green bag, and a roll of papers carefully wrapped up in cloth and tied at the ends, resembling a lot of plans of mines and minerals. Of course the advent created a sensation; and it now turned out that this persevering young Ironmaster had travelled from Stourbridge to St. Petersburg, and from St. Petersburg to the Ural mountains, and by the enchanting melody brought out of his instrument, so fascinated the Muscovite Ironworkers as to get to see their works-the only foreigner that ever was permitted to enter a Russian Ironworks which contained a slitting-mill up to that time. But our readers will be surprised to hear that Foley laid siege to the mill no less than two months before he was permitted to tread the precincts of the cutters, and he might never have succeeded, but for a singular circumstance, which opened the portals of Vulcan to him. Foley's money was exhausted at St. Petersburg; any effort to communicate with England for supplies would reveal his family connections and perhaps his object; therefore he resolved to look to his violin, which he loved so well, and with this heralded his advent from village to village, to the manifest delight of the long-skirted Russians with whom he continually came in contact.

At one place the priest ordered him into prison, but having heard so much of his music, came to hear him, and was so pleased with the melody as to order his re-When he arrived at the Ironworks, he found numbers of huts outside the works, where the men lived. The first day he fared badly, but the next day, Pietri Orloff, the principal man—as it turned out afterwards-at the mill, took him in and gave him a good dinner composed of boiled corn and tallow, which Foley declared these men were fond of. He likewise stated that they eat train oil. He knew French very well, and began to teach two of Orloff's boys French. He always made his way by French, for the Foleys were buying more of this nail-iron from Russia than perhaps any other English house: it therefore would have been imprudent to have revealed his nationality. Foley slept at Orloff's house, teaching the boys French, and fiddling constantly for his own amusement and that of the workmen, but never attempted to go into the works although he saw the precious nail-rods being carried away on mules' backs and loaded waggons drawn by bullocks. After two months, Orloff's two dogs became so fond of Foley that they refused to stay in the works, which were so infested with rats that the absence of these dogs became a matter of serious inconvenience. The largest and the best one, 'Estay,' would go with Orloff into the works, but invariably got back to Foley as quickly as possible to listen to the strains of the music. In this dilemma the manager suggested to Orloff that the French fiddler should be induced to play in the works, and be allowed a certain number of kopecks

according to the quantity of rats lestroyed, the name of the vermin now being legion. Foley fell in with the offer; the French fiddler and the dogs entered the works. Foley accepted the reward, had a bed stuck in the office in one corner of the works, where fiddling was carried on as usual. The dogs soon destroyed the rats, and the French fiddler became the greatest favourite with both managers and men at this famous slitting mill on the slopes of the Ural Mountains. Foley next undertook to make them some drawings of the Notre Dame Church at Paris, for which purpose he obtained paper and materials; and in this way at night, with no company in the office but the faithful dogs 'Estay' and 'Petri,' did he make his plans of the Russian slitting mill. We must now introduce our readers again to him at the Hyde Works. The object of his absence soon became known. The cutters were made, the mill was erected and commenced work; but, alas! it was a failure, it would not slit the rods. By some accident he had lost one section of his plan, and Foley became taciturn, moody, and disconsolate. Without the slightest intimation, after a lapse of six months, he absented himself again, and managed once more, with fear and trembling, to brave all dangers and fear of suspicion, manfully embarked on the journey, fiddling his way again to the same Iron works, where he was received with open arms by Orloff and the workmen, the dogs not being the least overjoyed at the second advent of the Frenchman. He took up his old quarters in the office, remained at the works twelve months, often worked the slitting mill himself, made sure of his plans this

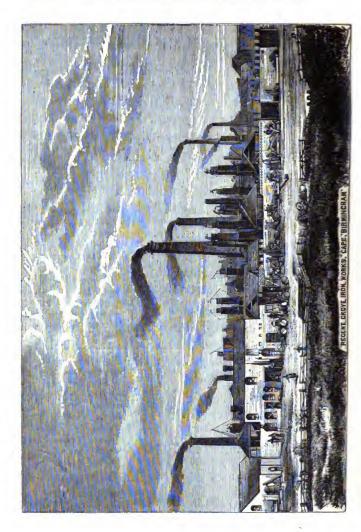
time, returned to England, erected the slitting mill, made splendid rods, better cut and of better Iron for nail purposes than the Russians, and what perhaps was at that time most pleasing to him, introduced a new manufacture into the metallurgical industries of his native country. The above facts have been obtained by us from private friends 1 at Stourbridge, who had been known to the father and grandfather of the editor of the 'Guide,' and may be taken as the best history of this marvellous young Ironmaster on record. How Mr. Foley got there and back we cannot say; we know he did not go by a steamer to Ostend or Dover; we know too that he did not travel by rail to London nor by canal; nor did he put his foot into a railway car in Russia, or effect his advent to Moscow other than on foot. We know likewise that he had no steamer to paddle up the Neva and drop him down at St. Petersburg. All this we know, but his privations, sorrow, trouble, and anxiety, with perils by sea and land, we do not know. The Hyde Works, however, established by the ancestors of this noble family, still stand as a memento of the advantages conferred on England by such families as the Foleys and such firms as Messrs. Lee and Bolton, who for many years have been the proprietors, and still make the best slit rods, wire rods, best bars, best best ditto, boiler plates, sheets, singles, doubles, plating bars, and in fact all kinds of Iron of the best quality.

<sup>&</sup>lt;sup>1</sup> Mr. Rowland Price solicitor, and Mr. Padwick the engineer at the Stourbridge Works.



## THE REGENT'S GROVE AND EYRE STREET IRONWORKS.

The engravings annexed represent the Regent's Grove works, being the largest and most important of this firm, where their famous charcoal sheet Iron of best, best best, and best best best are made. They likewise manufacture corrugating sheets, Russian roofing sheets, Indian sheets, and Canada plates, and indeed all kinds of sheet Iron used for galvanising purposes: sugar moulds, kegs, drums, tank-plates, and plates to be tinned. As a manufacturer of sheet Iron Mr. George Beard's practical experience and ability may safely be said to be quite equal to that of any Ironmaster in the United Kingdom. It will be remembered that Ambrose Beard and Sons formerly carried on a successful business at the Regent Ironworks, where the brand of Ambrose Beard and Sons obtained a celebrity in sheets which will always attach to the name of Beard. Mr. George Beard for some years has been in partnership with Mr. Eberhard, who is closely connected by marriage with a wealthy family at Smethwick, well-known in connection with a great metallurgical establishment at that place. Beard and Eberhard at these works continue to manufacture all the specialities in charcoal and other best sheet Iron, for which the old firm of Ambrose Beard and Sons were so noted, and rewarded by prize medals The works of Beard and at the Paris Exhibition. Eberhard are under the constant and exclusive personal management of Mr. George Beard, the former acting manager of the older firm of Ambrose Beard and Sons



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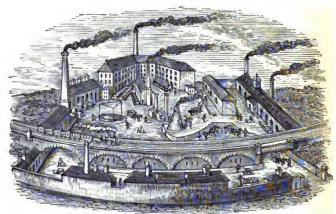
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AJUR, LENOX AND TILDEN FOUNDATIONS.

tegent Iron Works above referred to, and the cial department of these well-known works is a management of Mr. Eberhard. We feel quite saying no firm in Staffordshire is more likely satisfaction to high-class buyers than Beard and d, of the Regent Grove and the Eyre Street represented by the woodcuts annexed.

MINGTON AND Co., SUMMER HILL IRON WORKS, TIPTON.

works were established by Mr. William Millington and his broah Millington, upwards of half a century ago, and are situated to the spot where the Tipton old church formerly stood. ts still belong to, and are carried on by Mr. William Millington nephew, Mr. Samuel Lees Millington. The latter resides at bury Oak House, formerly occupied for so many years by the late Williams, Esq., which will be remembered with interest by most old eminent Ironmasters who have, from time to time, visited Mr. Phillip Williams, who for the influence he exercised for wer the trade, astuteness in all commercial matters, and sound a sense, had no rival in the Black Country. These works are seful than ornamental in their external aspect; the works, howhemselves, the steam engines, rolls, and machinery are abreast progress of to-day; the boiler plates, and other kinds of Iron by this firm are known and appreciated in the market. and Co,'s boiler plates were honourably mentioned at the Paris ation, with Earl Granville, Shelton Bar, Barrows and Hall (the and the British Iron Companies, and from that day to this on of this firm has maintained a high position in all markets, being taken here to select good Pig Iron, and Mr. William Milwho, from the first was a thoroughly practical man, having intly paid personal attention to the construction of his works, the quality of his brand of Iron. In our own recollection the have been enlarged from time to time, and improvements and vations made, until the completion was obtained as represented in engraving opposite.



HORSELEY FIELDS CHEMICAL WORKS,

### CHAPTER XVI.

THE HORSELEY FIELDS CHEMICAL WORKS, WOLVERHAMPTON, PROPRIETORS, MESSRS. WILLIAM BAILEY AND SON.

THESE well-known works were established nearly half a century ago, having been first opened in 1828, by Mr. William Bailey, and during this long period have acquired and retained, through the energy, industry, and perseverance of the present senior partner and founder, a world-wide celebrity for the philosophical, medical, chemical, and photographic preparations they have produced.

Some of those domestic medicines now to be found in all countries and in every druggist's shop were first

issued to the trade from the above-mentioned works, and a large number of those chemical salts and preparations which, at the beginning of the present century, were merely 'laboratory curiosities,' handled by learned professors with a kind of scientific reverence due to their rarity and costliness, have been, under the influence of gradually improving methods of manufacture at these works, rendered capable of being readily and cheaply produced, so that at last they are supplied by tons instead of ounces, and play no unimportant part in the trade and manufacturing processes of the country. As an example of the former class, we may point to the fluid magnesia, now indissolubly connected with the name of William Bailey; and as an instance of the latter, the curious volatile fluid called bisulphide of carbon may be taken. This was discovered in 1796 by Lampodivus, and has been an object of interest and study to many chemists since that date. Its great solvent powers for India rubber, gutta percha, and resinous gums, its inflammability and general characteristics, fitted it for a variety of purposes in the arts; but its high price proved for a long time a barrier to its commercial use. Liquids costing a sovereign a pound are hardly capable of very extensive application; now, however, bisulphide of carbon can be purchased for less than 6d. a pound, and is consequently manufactured by tons. Shortly after the Great Exhibition of 1851 it was proposed to be used for war purposes by Mr. Wentworth L. Scott, of whose Volcanic Shells and

Now well-known by his researches upon the chemistry of food and sanitary science.

Annihilating Fluid it formed an important constituent. About this time Messrs. William Bailey & Son, the firm who first produced this fluid as an article of commerce, were selling it at about ten or twelve shillings a pound, and since that time their production of it has continually increased, until, as we have said before, it is now dealt in by the ton, and is largely used for the extraction of oils from seeds, wool, cottonwaste, and other substances.

Hyposulphite of soda may be cited as another original specialité, for many years peculiar to Horseley Fields Chemical Works, but now largely manufactured throughout Europe. As our readers are doubtless aware, this salt is the sheet-anchor of photographers after nitrate of silver, as, until very recently, it was upon his 'hypo bath' that he depended entirely for the 'fixing' of his solar pictures. In Manchester and elsewhere it is used for what is termed Antichlor, by which the excess of chlorine is removed from their bleached goods. This product brings us quite naturally into photography, but space forbids us descanting upon the photographic chemicals manufactured at these works. Suffice that the several preparations associated with the name of that veteran photographer, Mr. Thomas Sutton, are prepared solely at the Horseley Fields Chemical Works.

Whether in relation to medicine, photography, or other applied sciences, the *purity* of chemical preparations is, of course, an all-important point, and it was owing to this quality that a medal was gained by Messrs. William Bailey & Son's preparations at the

International Exhibition of 1862. This firm has for years been entrusted with the manufacture, on a large scale, of chemicals for the War Department and Post Office; and more recently the telegraphic section of the latter has sought supplies for its batteries from the Horseley Fields Works.

A special list of telegraphic chemicals informs us that no less than forty-six acids, salts, and other preparations, are manufactured for the uses just indicated, and supplied to Her Majesty's government and the principal railway companies. Mercurials, an old specialité of the firm, hold a prominent place herein, as also in the Pharmaceutical List proper. Beanes' patent brewing material, and Bailey's universal finings, as sanctioned by the Board of Inland Revenue for the use of brewers, are also among the articles manufactured at these works. The most important preparation of all, however, in Messrs. William Bailey & Son's manufactory is, perhaps, their patent bisulphite of lime, the uses of which, as a preserver of fresh meat, a regulator of the fermentation of malt liquor, a restorer of musty casks, and a preventive of cattle disease, are becoming more and more appreciated in all civilized countries, and must be tolerably familiar to our readers.

Our hurried notice of Horseley Fields Chemical Works shall conclude by narrating that the latest event in its history was the visit of the Burmese Embassy and suite, which took place in November last, when their excellencies spent a considerable time in inspecting the various processes and appliances, and expressed themselves as having been more interested

therein than in anything else they had seen in the Midland counties.

Being ourselves members of the Pharmaceutical Society of Great Britain from its foundation, and having studied chemistry at one of the principal laboratories in Wolverhampton for two years, during which time we were permitted to visit and improve ourselves in the art of practical chemistry at this famous laboratory, we have much pleasure in giving a brief sketch of this great establishment, which has a world-wide fame, and which has always supplied us with acids and other chemical products employed in ferruginous and metallurgical analysis, purity of the chemicals being a sine quâ non for correct determinations.

# BLAKE'S STONE-BREAKERS AND ORE-CRUSHERS.

So Well known are these machines (Blake's Stone-breakers and Ore-crushers), manufactured by H. R. Marsden, the sole proprietor, at the Soho Foundry, Leeds, that it is often the case that journals in the trade, and out of the trade too, in noticing any new improvements of the same, say, 'Of the machines themselves it would be superfluous for us to speak, their merits being so well known.' Now we can readily endorse the statement as to their being well known, and also that they are in extensive use all over the world; but when we consider the numerous uses to which these machines can be put, we are bound to say their merits are not so well known, or rather appreciated, nor are

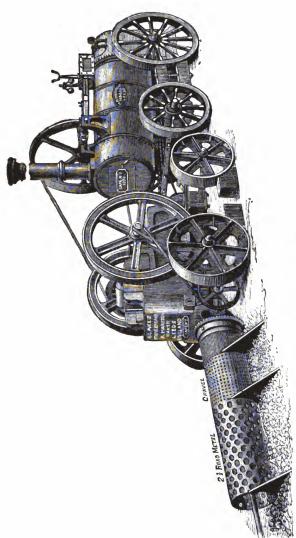
they in such extensive use as they ought to be, looking at their intrinsic value. It is indeed surprising to many to hear that Marsden's Stone-breakers are used in the remote, and till lately to some extent the unapproachable, islands of Japan, that Marsden sends out his machines for use on the Ceylon and Cape railways, under the auspices of Her Britannic Majesty's Government; that Marsden's machines are dragged up the mountainous heights of Bolivia and Peru by mules for



ore crushing. With this view we illustrate, on a small scale, one or two of Mr. Marsden's numerous machines; the first is the fixed machine, with revolving screening apparatus, and fitted with H. R. M.'s new patent cubing jaw for the production of road metal, of a form, as the name of the jaw implies, best suited for road making.

This machine ought certainly to be used in every town ship and highway district; when it is remembered how high the price of labour at present is, and that the cost per ton for hand-broken stone is at any rate from 1s. 6d. to 3s. in different districts, for labour alone, and that by these machines the cost is not more than 11d., or to go to the outside  $1\frac{1}{3}d$ ., per ton, we think it will be readily allowed we do good service by urging this matter upon the notice of all corporations, road trusts, and highway boards. The next machine we illustrate is of the same class, but instead of being fixed it is upon wheels, with horse-shafts, to travel, and can also be so arranged as to be combined with Marsden's Steam Road Roller. Then he has a smaller machine, upon feet, for use when less quantities are required, and when it is desirable to dispense with steam and use only hand power; in fact these can be worked by hand or steam power as desired; they are very useful for sampling, or even for doing the same class of work as the larger and more powerful machines. The fourth machine we illustrate shows great economy of space, being an engine and machine combined, for use where space is an object, or where driving-belts and gearing are objectionable. Mr. Marsden has machines in many varieties, all designed for the purpose of breaking or crushing, as needed, the hardest of materials to any required size; and lastly, for his numerous patents and improvements he has received, at the hands of the best judges at such as the R. A.S. shows, and other exhibitions, upwards of thirty first-class gold and silver medals. Our readers should enquire for themselves,





and if their enquiries are satisfactory, adopt whichever machine their peculiar work requires, and they will find that they are able to produce *more* work in *less* time, with *greater* economy, in *smaller* space, and with very much less cost of labour, than heretofore.<sup>1</sup>

<sup>1</sup> A short time since we witnessed with pleasure one of these large machines in operation at the noble Earl Granville's Prior's Lee Blast Furnaces, where the monster crusher did its work marvellously well upon the Argillaceous Shropshire Ironstone, so largely consumed at these famous Iron works.

### CHAPTER XVII.

### NORTH AND SOUTH WALES IRON DISTRICT.

NORTH WALES has 10 blast furnaces, 2 at Brymbo, belonging to the Brymbo Company, 3 at Ffrowd, Sparrow & Poole, 3 at Ruabon, and 2 at Mostyn. The Ffrowd pigs are of superior quality, and fetch a high price in South Staffordshire, being highly approved of by the Staffordshire makers. Brymbo are likewise well known for strength and other desirable qualities. There are 19 blast furnaces using anthracite coal in South Wales; Glamorganshire has 12, Brecknockshire 14, and Monmouthshire 62, which comprise the South Wales group, the Ebbw Vale Company being the largest works in Wales, having 21 blast furnaces in Wales; say at Abersychan, 6; Pontypool, 4; Sirhowy, 5; Ebbw Vale, 3; Victoria, 3; 1 in the Forest of Dean; in all 22; they have likewise 4 large mills and forges, 9 mills for rails and plates, namely, Abersychan and Pentwyn, Victoria, Ebbw Vale and Pontypool, in all 180 puddling furnaces, and 4 Bessemer converting cauldrons, 8 tons each. Their coal and Iron mines are perhaps the best and most extensive in Monmouthshire. Mr. Alderman Curtis, of Manchester, is the chairman of the Company; Mr. Joseph Robinson and Mr. Carter are

the London agents; Mr. Rowbotham, secretary.1 This company are expected to make large profits next year. Next to this Mr. Robert Crawshay, of Cyfartha, and the Aberdare and the Llynvy Company have the largest number of puddling furnaces in Monmouthshire. The Dowlais Company have 17 blast furnaces and 161 puddling furnaces at Dowlais; Fothergill & Hankey have 10 blast furnaces, and 54 puddling furnaces; and the Aberdare Company have 5 blast, and 60 puddling furnaces. These are the largest Ironmasters in Wales, the bulk of their own Iron being rolled into rails. While we write the men are all on strike for wages, all these works having been closed for a whole month. There are numerous other large works in South Wales which will be found in the list in the 'Guide.'

There are several large works in Wales that work on bars, the Llynvy Vale, Plymouth Forge, Cwmbrian and Blaenavon; the bulk of the Iron, however, produced here for years past has been converted into rails; the largest makers of this article being the Ebbw Vale Company, the next in this respect is the Dowlais Company. Without doubt the Welsh Ironmasters as a body are amongst the most wealthy makers in England. All old-established concerns, sometimes, in adverse state of trade, are compelled to work month after month, almost without profit, with a view of keeping the men together, and patiently waiting for the advent of better

<sup>&</sup>lt;sup>1</sup> Mr. Grove, the late secretary, has taken an important position, at the request of the Board, in Wales near to the works, and Mr. Rowbotham has been appointed secretary in his stead.

prices. The interval from the close of 1866 to 1870, was a specimen of the bad times above referred to. A reference to the table following shows that, although the Iron trade generally was so good last year, there was a considerable falling off in the demand for rails for export, which the Welsh masters depend upon, the United States being conspicuous in the diminution of requirements.

Rails Exported in 1872 to the Countries below	Month		Year	
	1871	1872	1871	1872
Railroad Iron of all sorts— To Russia	Tons 894 801 648 255 6 1,173 16 2,400 37,372 143 1,124 2,337 9 216 1,219 9,461	Tons 7,261 1,114 939 1,373 29 1,883 51 1,556 31,686 547 1,578 1,968	Tons 78,367 10,918 50,287 14,868 3,653 12,199 24,260 16,759 512,277 3,848 20,519 22,262 11,130 61,961 34,523 14,691 81,675	Tons 106,305 12,272 50,275 9,026 2,120 11,010 7,988 14,472 472,760 2,315 20,710 34,874 2,845 77,248 14,652 25,091
Total	59,127	65,938	981,197	947,548

## CHAPTER XVIII.

#### SCOTLAND.

Whatever branch of trade our good friends beyond the Tweed take up, a combination of perseverance and shrewdness (the most prominent feature in the Scottish character) enables them to run a fair race with, and often rival us in great industries. The ship-yards on the banks of the Clyde, the jute mills at Aberdeen, and the industries of Paisley, all corroborate, in an eminent degree, this view of the question. Iron is another instance of the successful perseverance of Scotchmen.

The time-honoured Carron Foundry too, in the thousand and one articles fashioned here, defies the competition of England, and regularly makes its fair share for the requirements of England and other countries. Since the invention by a Scotchman, of hot-blast smelting, the Scotch Iron trade has been extended in a marvellous degree, and the consumption of No. 1 Scotch Iron, both at home and abroad, has increased in the same ratio, 616,933 tons. There can be no doubt that the quality of certain brands of Scotch pigs are far superior, for foundry purposes, to any other made in this or any foreign country. The superiority must be attributed to the variety of the kinds of Ironstone which

<sup>&</sup>lt;sup>1</sup> Exported last year.

abound in Scotland, and the admirable adaptability of Scotch coal, under proper manipulation, to the production of No. 1 Iron. The old districts of South Wales, Staffordshire, and Shropshire, make very little No. 1; and although Staffordshire has no less 1 than 198 blast furnaces, only 18 are at this moment working on Nos. 1 and 2. Out of these Messrs. Grazebrooks make a very old speciality, which does not compete in the general foundry trade, being cold blast and very high in price. Therefore the number of furnaces in Staffordshire making No. 1 Iron is only 16: not half the number of the furnaces constantly kept in work by the Scotch makers of the famous Gartsherrie and Eglinton brands; the reason of this being that the present coal of Staffordshire is not adapted to it: the only fuel left fit for making No. 1 is the thick coal; this being scarce, makers are unable tocompete with Scotland out of their own district: Staffordshire has long since abandoned the melting trade to Scotland. The ordinary melting pig Iron made in Staffordshire at the best, is very inferior to Scotch, and always will be so, the greater part being made from cinder.2 The young and thriving district of Middlesborough, during the last few years, has manfully kept abreast with Scotland in quantity; indeed in this respect leaving Scotland in the rear, but in quality it is still behind, and it is questionable whether it will ever be able to produce an article of any-

<sup>&</sup>lt;sup>1</sup> These figures embrace North and South Staffordshire.

<sup>&</sup>lt;sup>2</sup> H. B. Whitehouse & Sons, of Priorsfield, being rich in thick coal are an exception, and still make the very best melting Iron. Their brand is in high repute, selling to-day at 7l. per ton.

thing like equal value in No. 1 to Langloan, Coltness, and Gartsherrie; never, we believe. The Scotch smelting firms are the most extensive in the world, W. Baird & Co. having no less than 37 blast furnaces, the Coltness Company 12, and the Monkland 9. The largest number in Wales, by one Company (the Ebbw Vale) is 22, and in England 1 17, the Right Honourable Earl Granville's, chief partner at Lilleshall, where there are 9 furnaces; his Lordship also has 8 blast furnaces at Skelton, in Staffordshire, in all 17 blast furnaces. That which redounds, however, most to the success of the Scotch makers over all others, is their ability to make such a very large proportion of superior Scotch No. 1 pig Iron, commanding the highest price both at home and abroad; the brands to-day of No. 1 being 165s., F.O.B., in the Clyde; the make of Scotland last year was 1,090,000 tons, being a decrease of 70,000 tons on the previous year, owing, we believe, more to the unwillingness of the men to bring the usual quantities of coal to grass than any other circumstance. It has been said that Ironstone is getting scarce. We cannot endorse this hypothesis. Scotland abounds with Ironstone of the very best kinds for foundry Iron; we speak advisedly when we say that the Shott's Company, at Castle Hill, and other leases contiguous thereto, have Ironstone mines which, if opened, would be capable of supplying 50 blast furnaces for 50 years; probably some of the great makers may not be in such a favourable position in respect to mines; on the whole, however, Scotland has nothing to fear on this head.

 $<sup>^{1}</sup>$  The Great Barrow Steel Company have 16, Bolckow & Vaughan 15.

Coal is another question. The No. 1 Iron of Scotland draws largely, nay much larger per ton of Iron, on the coal mines than any other country, simply because they make most No. 1, which everybody knows consumes proportionately more coal than No. 2, or lower numbers of forge Iron generally made elsewhere; and if Scotland retrogrades from any other cause than the follies of the colliers, we must attribute it to a deficiency of coal, a good and cheap supply of which is a sine quâ non for the profitable manufacture of No. 1 melting pig Iron. We put this as a mere hypothesis, believing as we do that the vast stores of coal in the crust of the earth in Scotland are adequate to the craving requirements of the 127 furnaces now in blast, and, if the colliers will only attend to their work regularly, it can easily be brought to grass, keeping the make of Scotch Iron up to the normal point. In the manufacturing departments Scotland has not kept pace with her smelting furnaces; she has but 339 puddling furnaces, far below the number of either Staffordshire, Wales, or Middlesborough. There are 14 manufactories, the Mossend Iron Company, at Hollytown, and the Blochain, near Glasgow, being the largest. We have not visited the former; the latter works, however, we are well acquainted with, and can say, without fear of contradiction, that the works are quite equal to anything of the kind in England, and are capable of rolling large plates and angles in a state of perfection very rarely equalled at any works in Great Britain, the quality of the plates deservedly taking the highest position in the market. Scotland has made little pro-

gress at present in the Bessemer process. It is questionable whether she will ever be able to take the lead in this department to the same degree as she has done in melting Iron, the Scotch Ironstone being unfavourable to the production of pig Iron of the sort most desirable for manipulation in the Bessemer pots, owing to the presence of phosphorus in Scotch mineral. We are aware that much has been said and written in favour of Spanish Ironstone, but the fact stares us in the face, that the hæmatite ores of Cumberland and Barrow in Lancashire are the best in the world for this purpose, both in quality and the quantity of the Bessemer Iron they yield; besides which, these ores are free from phosphorus, which is a sine quâ non. There are various reasons in our opinion why Scotland will never be able to compete with Barrow-in-Furness, and the Frizzingdon district of West Cumberland, in the manufacture of Bessemer Iron. Spain, Lancashire, and Cumberland can never give them hæmatite ores to enable them to compete with Lancashire and Cumberland in Bessemer pig, particularly when considerably lower prices rule the market for the metal, which we must expect in due course.

The Steel Company at Barrow-in-Furness have two hæmatite mines capable of supplying all their 16 blast furnaces and to spare. The Park Pocket alone has yielded 365,000 tons annually for the last ten years, and is more promising than ever. The other, called the Stank, is likely to turn out still larger quantities, and Sir William Fairbairn, after carefully analysing this ore, says it makes the best Bessemer Iron in England.

### CHAPTER XIX.

### THE CARRON FOUNDRY.

THE Carron Foundry is the oldest in Scotland and was established 1760. The manufacture of Iron of all kinds, however, in the whole of Scotland over the succeeding twenty-five years did not exceed 1,500 tons per annum. Cort's invention of puddling and rolling in 1783 and 1784 gave great impetus to the trade. We know from Sir J. Sinclair's statistical account in 1792 that these works consisted of five blast furnaces. made their own firebricks, had a water-engine that worked seven strokes a minute, and raised 3,500 gallons of water at one stroke. The same engine consumed sixteen tons of coal in twenty-four hours. There were likewise three cupolas and air furnaces: the cupolas blown with blast from the blast engine. There were four boring mills to bore guns, cylinders, &c. Anchors, cables, and anvils were made here. There was a forge for making malleable Iron, and a drawingout forge, and convenience for marking bar Iron with the brand it was intended to bear after its conversion into steel. &c.

The cast Iron hammer and elve weighed one and a half tons.

The original Ironworkers employed here were imported from Russia and Sweden—the great Iron-making

countries at this period. The Russian manager put up a slitting-mill, but only to slit the old hammered bars made by the ancient process in use before Cort's Patent. It must be clearly understood that they were unable to slit nail rods here. (Foley must have the honour of introducing this process at the Hyde Works, Stourbridge, still carried on by the well-known firm of Lee & Bolton.)

At this period Russia imported into Scotland 1,000 tons of malleable Iron per annum. The import duty was £3 16s. per ton. The cost of Russian Iron, delivered in Scotland, was £17 per ton, and the best Swedish, Danemora, shipped at Oregund, fetched £24 per ton. The Carron hammered this into charcoal bars, and marked it with the brand for making steel. Other Swedish Iron was imported of less value, as low as £18 10s. per ton. Foreign Iron advanced very much in price from 1780 to 1791, which stimulated the crection of the Clyde Works, which, we believe, came in succession to the Carron. In 1839 the trade had considerably expanded. The Monkland Iron Company, Dunlop, Wilson & Co., of Dundyvan, the Muirkirk Iron Company, William Dixon, of the Govan Iron Works, were all established in making bar Iron. There were likewise two small forges at Lancefield and the Gartness. These were all the malleable Iron works in Scotland up to 1839. From this period the pig Iron trade in Scotland has increased in an accelerated ratio, but the malleable Iron trade appears now stationary: only 200,000 tons of pigs were consumed last year in this department. The great firm of W. Baird & Co. have not at any time embraced this department of the

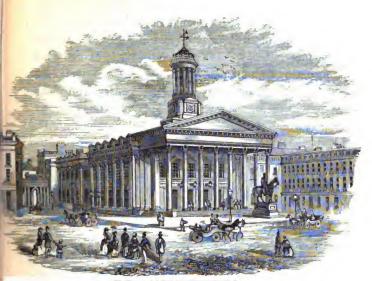
trade. In concluding this chapter, we congratulate the executive administration of the old time-honoured Carron Company, the founders of which did more to introduce Iron making, steam engines, anchor and steel making in the United Kingdom than any other firm. It is likewise pleasing to observe that the produce of this ancient foundry keeps abreast in the markets of the world with all other competitors.

The brand of Steel Iron made by the Carron Company stood very high with the converters, and after puddling and Cort's rolling were introduced it was a common practice to planish large-sized bars, which could now be made much cheaper by Cort's plan, say from  $2\frac{1}{2}$  by  $\frac{3}{4}$ , and upwards, under the elves of certain ordinary forges known to us in Staffordshire. Spare hammers and anvils were kept in readiness, adapted with a smooth surface for this purpose. After the week's work had been got through the elve was thrown back from the arm so as to modify the blow, and planishing often was carried on until twelve o'clock on a Saturday night, the bars being stamped with a well-known Carron brand and shipped abroad as the genuine article for conversion.

We are glad to say that this practice has been abandoned many years, but that it did exist there is no doubt. We have often seen it practised at Millfields fifty years since, and an Iron-master at the head of a firm of high repute can speak to the same fact, for his father-in-law and Joseph Bladon had the shingling at these works and did the planishing and branding above referred to. Joseph Bladon was the best shingler in Staffordshire, and was father to the managers of this name who have managed at Earl Granville's, Joseph Bull's, Cliffvale, the Bloehain in Scotland, and other eminent works in the North, with so much credit to themselves and satisfaction to their employers. We give this as information in the history of the Trade, believing, as we do, that this very questionable practice is now obsolete.

There are other foundries in Scotland which deserve special notice equally with the old Carron Foundry. Andrew M'Laren and Company, of the Albion Iron Works, Alloa, N.B., and 174 Upper Thames Street, London, have extensive foundries, and their produce has taken a high position in the London market. The Albion Iron Works are noted for their stoves and ranges, high-class register stoves, and grates of all kinds, of the newest patterns and most useful construction. Ornamental and plain park railings, altar railings, balconettes, stair balusters, pilasters, columns and verandahs, including a very large variety of garden chairs, flower stands, tables, and fountains, and all kinds of graceful and elegantly constructed garden work, all kinds of rain water connections, hot water pipes, and gas pipes.

The grace and elegance of the articles, together with the finish and smoothness of the castings turned out at this foundry, places them in a position in this market second to no other establishment in the United Kingdom. Mr. Andrew M'Laren attends to the London business himself in Thames Street, and Mr. John Baker superintends the works in Scotland, the goods being shipped direct from their works in Scotland to their wharf in the Thames. We have often admired their beautiful castings at the great warehouse and show rooms in Thames Street. Their tables are the most elegantly designed and beautifully executed Iron furniture made at any foundry, elegantly bronzed in the best Their new designs are mostly created here, the very highest class modelling artists being always engaged and at work in Thames Street. The tables above referred to are often seen, indeed generally used to furnish the first-class restaurants of London and the Continent.



THE GLASGOW EXCHANGE.

# CHAPTER XX.

### SCOTCH IRON WARRANTS.

What is a warrant for Scotch pig Iron? The numerous subscribers to the 'Iron Trade Circular' have written to us for an answer to this question perhaps a hundred times, and although a warrant is simple and easily explained, our friends from time to time have difficulty in comprehending how a piece of paper can represent the value of a thousand tons of pigs, indeed, how the pigs themselves, the hard metal stacked in

<sup>&</sup>lt;sup>1</sup> Now called the 'London Iron Trade Exchange.'

Connal's yard, acknowledge their owner when the warrant is signed by Connal and Co., the keepers and guardians of this enormous fold of pigs. Thirty years or more, since, when the Scotch trade had expanded, the stocks had accumulated at the works, the demand fell off, makers wanted buyers, the price of pig Iron was reduced to zero. Merchants and others in Glasgow, took pigs from the makers at these very low prices until the quantity held in this way by merchants and speculators, formed an important item in bulk and value too. These pigs ab initio remained on the pig banks of the makers and were bought and sold as a separate commodity, as 'makers' engagements.' The merchants relying on the maker to deliver to bearer, according to the scrip which he held, and which the holder had bought from Mr. A. or Mr. B.

Our Scotch friends are proverbially a little 'canny,' and thought the pigs would be more truly in their own possession at a public wharf; however this may be, we know, as old bankers, that a warrant made out by a public wharfinger for the metal which it represents on the wharf, is as safe for conversion from paper into metal off the said wharf as a Bank of England note is for gold; besides, the Messrs. Connal are kind, obliging, painstaking, gentlemanly and considerate. The holder of any warrant gets it transferred into his own name, or that of his nominee, in a few minutes; one of the Messrs. Connal, or Mr. Young, being always there in business hours, every facility is rendered, not the slightest indication of 'red tape' existing in the office. The warrant is presented, and in a few minutes a new

name and owner is marked in Connal's register at the small charge of 1s. for each hundred tons, and that instant the former owner's legal right vests in the buyer, and the document taken away 'de jure et de facto,' represents the thousand tons of metal, as much as a note does a thousand sovereigns at the Bank of England. Did we say as much? if you please we will say more The warrant is convertible into metal under any combination of circumstances. We cannot say this of the Bank of England, the precious metal is not there to meet all the notes out. The pigs, or the metal, are always in Connal's store to meet every warrant out, and any holder may go and examine them as we have done. There they are, stacked and piled in metallic towers. The Messrs. Connal have kept this store for thirty years. The warrant is a more convertible note of the Iron than the bank note is of the gold which it represents. Glasgow Iron merchants are the most extensive in the world, and as we before stated, they thought it just as well to have the stocks in their own hands: their 'canny' bankers we are sure would commend their prudence in this respect. They appointed the Messrs. Connal their general storekeepers of this Iron, agreeing to pay them so much per ton for unloading, stacking and reshipping, varying from 1s. to 1s. 6d., at present 1s. 6d. to 1s. 8d., paid by the parties storing the Iron, at so much per month rent for every ton sent, while the Iron remains in their possession, a very satisfactory arrangement, we should think, for all parties. When a large business is being done in and out, we suppose the Messrs. Connal do tolerably well, small as their fees are. When trade falls off, then

the revenue of the wharf depends more on the trifling sum paid for rent, but the Messrs. Connal never grumble, but patiently wait for better times and more business. We should remark here that the freehold of these gigantic yards is the property of Messrs. Connal. Since this store has been established, competitors have started with opposition stores, the railway company being the most formidable. The willing attention, however, and obliging manners of the Connals leave their stores without a rival. We think the Railway has about three hundred tons; formerly the Carron Company held a large stock, but this old stock being cleared off and each of the other makers holding at present but very moderate quantities in stock, Connal's store now contains the only available stocks worth mentioning, and the only pigs which are sold by warrants passing from one merchant to another in no other way than that now in practice, viz., by certificates or warrants, whichever you please to call them, made out by Messrs. Connal the Storekeepers, copied from their register of each lot, which is the legal register of ownership of such lot of Iron being held by the storekeeper for and on account of the registered owner. The freehold of the wharf being the property of the wharfinger, the Iron is safe against all claims and contingencies, except the legal charge for rent which makes the warrant legal and the Iron safe to the owner against any contingency, rent excepted.

It follows that the holder of such a registered warrant has possession of the Iron as securely as if the metal was stacked in the holder's own yard. A word on the Glasgow Exchange must close our remarks on Scotch Warrants.

The Exchange is a handsome building, abreast in all respects with Glasgow and its Iron-making surroundings. The Iron Market opens at 11 o'clock; the merchants assemble here punctually, and by a peculiar instinct monopolize any spot they choose in the Grand Area of the Exchange, and a foreign interloper quickly comprehends that he is not wanted in the 'ring.' Numbers of the old firms avoid the active part of the business on the Exchange; still, they are there to instruct the junior partner or authorized clerk who does the business; there are likewise numerous highly respectable merchants who do their own business. In times of excitement and rapid changes in price the scene in the Iron Circle on the Glasgow Exchange is interesting in the highest degree.

At 11 o'clock all are punctually there, 'bulls' and 'bears' rush to the spot, the tallest leaning their heads over from the outer circle, attentively listening to the conversation and offers of the inner circle of the group.

The reader must observe that the group consists entirely of Iron merchants; probably ten or fifteen minutes elapse without business. The greatest attention is directed by the outer circles of the group, now to the great 'bulls' in the centre of the 'ring;' the throng increases, outsiders feel more interested at a distance; this Iron group becomes now the observed of all observers.

The merchants now appear more intensely anxious,

<sup>&</sup>lt;sup>1</sup> See engraving on page 169.

standing on tiptoe, eyes and ears exercised to the utmost, as though something very important was transpiring. In an instant the physiognomy of the group changes, the anxiety to see and hear ceases, the group partially breaks up, the leading men appear to take breath and indulge in conversation with those around them, and everybody tells his neighbour pigs are up 2s. per ton, 2,000 tons having been sold for cash at this advance, and numerous buyers at the same figure. The first sale fixes the price for the moment. After a little pause the same throng fix themselves perhaps on another spot, a repetition of the former scene ensues, telegrams are seen handed about the Exchange, probably an advance of another 1s. is established; the morning market closes a shade easier. Business is suspended in Iron until two o'clock, when this extraordinary group re-assemble and, in exciting times, an advance of from 3s. to 5s. per ton, in a day, has often been established.

MESSRS. HAYWARD TYLER AND CO.'S WORKS, FOUNDRIES AND FITTING SHOPS IN WHITECROSS STREET, LONDON AND LUTON, BEDS.

The business of Messrs. Hayward Tyler & Co., of Whitecross Street, London, and Luton, Beds, may rank among the oldest treated of in these pages. It appears to have been established in 1815 by William Russell, a pupil of the celebrated Joseph Bramah, and for many years was conducted on a scale not very extensive in Clerkenwell, London. The branches of engineering carried on were those to which Mr. Bramah had given so much attention, and of which he may be almost named the founder, viz., hydraulic presses and machinery for making soda water. In 1827, Mr. Russell's hands were strengthened by the able co-operation of Mr. John Briggs, who still continues his valued and efficient assistance to the present proprietors of the firm. In 1835, on Mr. Russell's death, the business was taken by Mr. Hayward Tyler, who carried it on until his death in 1855, when it was purchased from his widow by Mr. Robert Luke Howard. This gentleman and his brother Mr. Eliot Howard are the present heads of the firm.

The extension of this business has not been on the same very rapid scale as that of some much younger concerns, but the motto of the firm has always been 'slow and sure,' and they have aimed at excellence in every branch which they undertook, rather than at those sudden increases which are often incompatible

with the same attention to the quality of the output. It is mainly under the present proprietors that the business has gradually assumed its present dimensionsand until lately the whole of their manufacturing has been carried on in Upper Whitecross Street, London, a locality where few visitors would at first sight imagine what a busy hive of industry was to be found behind the very unassuming exterior. Here may be seen the very utmost economy of space compatible with the convenience of work, and the most intelligent application of modern science and the principle of subdivision of labour to these branches in which the firm have long held a leading position, namely, all the higher classes of brass founders' and coppersmiths' work and hydraulic engineering. Almost every description of pumping machinery is here made, and its strength and finish challenge comparison with any other factory in the world.

Most interesting too is the workmanship of the various classes of machinery for soda water making, in which difficult branch of engineering the firm have for almost half a century had undoubted pre-eminence, and also hydraulic machinery of which they may be said to be the oldest makers, their business dating back to the great Bramah himself and possessing an incredibly varied stock of patterns, amongst others, the original ones of Bramah, which they bought when he died.

The trade, however, which of late years has brought them most before the general public, is their manufacture of Direct-Acting Steam Pumps. Their 'Universal' Steam Pump possesses a great advantage over others in its simplicity; the Engine portion having only two moving parts, and dispensing entirely with tappet-valves and other contrivances so liable to get out of order, as well as with fly-wheels and wasteful gearing.

They have been applied in great numbers and with the most satisfactory results to all classes of deep-mine pumping-sometimes worked by steam, sometimes by compressed air, sometimes slung by chains from the surface and lowered as the water was reduced; at other times placed in 'slants.' The accounts of their performances would be difficult to believe, if they were not confirmed by unimpeachable testimony, such as their continuing to work in repeated instances after they had been 'drowned out' by a sudden rise of water, and actually working themselves high and dry again. It is sufficient to say that, although other makers were well represented at the Vienna Exhibition, these were the only direct-acting Steam Pumps in the English department which received the grand prize 'Medal for Progress,' and the leading engineering papers concur in their testimony of their superiority; thus, on August 1, 1873, 'The Engineer' speaks: 'Although there are a variety of direct-acting Steam Pumps exhibited, none that we have seen work so quietly as those of Messrs. Hayward, Tyler & Co.'; and 'Engineering,' July 11, 1873, says: 'The "Universal" Pump can certainly claim to be the simplest machine of its kind in the Exhibition.'

Messrs. Hayward, Tyler & Co. have lately found it necessary to have increased space for their manufacturing operations, and last year erected a factory at Luton, Bedfordshire, conveniently situated on the high roads both to the north of England and the Black Country, and here they have already a large number of men at work on their various manufactures.

## CARPENTER AND TILDESLEY, LOCK MANUFACTURERS, SUMMERFORD WORKS, WILLENHALL.

As Messrs. Chubbs' is the representative factory in the lock trade in what is known as the 'levered' department, so is that of Messrs. Carpenter & Tildesley in what is known as the 'warded' department, of this important industry. The Summerford Works, situate at Willenhall, midway between Wolverhampton and Walsall, were established by the late Mr. James Carpenter, whose business as a lock manufacturer in the town dates from the year 1795. Mr. Carpenter was the first to introduce rim iron into the construction of locks, but his name is better known as the inventor and patentee of the perpendicular motion in the working of lock bolts, the use of which has now become almost universal. In the year 1839 Mr. Carpenter took into partnership his son-in-law, Mr. James Tildesley, the present sole representative of the firm, who personally superintends the entire operations of the establishment.

The Summerford Works give employment to 150 pairs of hands, besides 'out-workers,' and the average production of locks of the rim, dead, drawback, and mortice descriptions, varying in size from 5 in. to

12 in., and in price from 10s. to 100s. per dozen, is something like 250 dozens per week. Of these the greater proportion are exported to the colonial and other foreign markets, where the name of 'Carpenter' in connection with the lock trade has long been familiar as a household word. A noticeable feature of production is the 'double-handed' lock, the invention of Mr. Tildesley's son, and which Mr. Tildesley has secured by patent. The principle of this lock is, that it is equally adapted to doors opening to the right or to the left hand, and both the friction of working is reduced, and the shape of the latch bolt is free from the objectionable sharp angles of that in the ordinary lock. The 'double-handed' lock is made both in rim and mortice. and it already commands a very large sale, both in the home and export markets. Curry-combs to the number of 10,000 per week are also made at the Summerford Works, principally for the United States, continental, and home markets, and a large wood turnery is included in the establishment, door-knobs and curry-comb handles being the leading features of production. Rewards of merit for locks, lock furniture, and currycombs have been awarded to Messrs. Carpenter & Tildeslev at the various international exhibitions where examples of their produce have been displayed.

# Correct Particulars of the largest Iron Works in Staffordshire.

Robert Heath & Sons being the largest Iron Masters in Staffordshire, we give detailed particulars below of

### [148] THE LARGEST IRON WORKS IN STAFFORDSHIRE.

their Biddulph Valley Coal and Iron Works, the Norton Coal and Iron Works, the Ravensdale (Old) Iron Works, and the Ravensdale (New) Iron Works, including particulars of all the Coal and Iron mines of this important firm, who make bars, hoops, sheets, angle iron, small rounds and squares, and all other kinds of Iron on a more extensive scale than any other house in Staffordshire; their best qualities of Iron being equal to the other leading Staffordshire houses.

#### BIDDULPH VALLEY COAL AND IRON WORKS

situated at Black Bull, 3 miles from Tunstall, and 7 miles from Stoke.

Coal Pits						•	7	
Iron Stone	Pits	3 .					7	
Blast Furn	aces						4	(All working)
Puddling a	nd I	Ball F	urnace	es .			43	
Plate Mill	22	inch,	with				3	Heating Furnaces
Bar Mill	18	,,	"				2	,,
Bar Mill	10	**	"				2	**
1 Patent T.	hree	High	1 Mill,	capa	ble	of Ro	lling	
20 tons o	f SI	heets	in one	Turr	1.			

#### NORTON COAL AND IRON WORKS

situated at Norton,  $1\frac{1}{2}$  miles from Burslem,  $3\frac{1}{2}$  miles from Stoke.

Coal Pits			9	
Coal and Iron Stone Pits			5	
Blast Furnaces			4	(All working)
Puddling and Ball Furnaces			44	,
Plate Mill 22 inch, with			3	Heating Furnaces
Angle and Iron Mill 20 inch.	with		2	.,
18 inch.	with		2	.,

### THE BOWLING IRON COMPANY AT BRADFORD. [149]

### RAVENSDALE (OLD) IRON WORKS

### half a mile from Tunstall.

Puddling Furnaces		29	
3 Hoop Mills 9 inch, with .		2	Heating Furnaces
1 Hoop and Bar Mill 12 inch.		2	"
1 Guide Mill 8 inch		2	"

## RAVENSDALE (NEW) IRON WORKS

### half a mile from Tunstall.

Puddling Furnaces	28		
Dank's Furnaces (in course of erection)	9		
Plate Mill 22 inch, with Hard Rolls, 3	High	Louth's	Patent,
3 Heating Furnaces.			
9 Plate Mills 90 inch with 3 Heating I	Turnac	es to eacl	1.

#### SUMMARY.

Coal and Iron Stone Pits (now in full	work)		28
Blast Furnaces			. 8
Puddling and Ball Furnaces .			 144
			 9
Mills			 14
Heating Furnaces		٠.	 33

## THE PROCESS OF MAKING IRON AT THE BOWLING IRON WORKS.

At the meeting of the British Association at Bradford, Mr. Carbutt read before the Mechanical Science section the following paper on 'The History, Progress, and Description of the Bowling Iron Works,' by Mr. Joseph Wilcock, chief engineer.

### [150] THE BOWLING IRON COMPANY AT BRADFORD.

There are several indications in the Bradford district that Iron was manufactured here at a remote period of antiquity. It is believed that the Romans both got and worked ironstone in the neighbourhood. Dr. Richardson, the eminent botanist, writing to Herne nearly 200 years ago, stated that Iron was made in the neighbourhood of Bierley, two or three miles from Bradford, in the time of the Romans, as upon a heap of cinders being removed to repair the highway there, he had discovered a quantity of copper Roman coins. The ironstone cropped out in several places, and in many others it lay very near the surface, so that by making 'bell-pits' there would be no difficulty in getting the ironstone. Within a few miles of Bradford there are at work the old-established and still flourishing works of Kirkstall Forge, which claim to have been the first establishment to use rolls for slitting Iron into nail rods, this process having been carried on there so far back as the year 1594. Thus Bradford and the district may claim to have made Roman implements of warfare, and most probably Saxon, Norman, and old English ones In fact, this department was carried on up likewise. to a very recent period, when the Bowling and Low Moor Works manufactured cast-iron guns and mortars. At or about 1784, James Watt was completing his invention of a rotary motion steam engine, the introduction of which was only required to inaugurate a new era in the history of the Iron trade. It was about this time that the Bowling Iron Works were commenced, the first furnace being blown in the year 1788. Even before that date, however, we have records of some part of the works being in existence, and doing a limited trade in foundry and smith work. But as works for the smelting of ores, they date from the year 1788, three years in advance of the sister works at Low Moor. This was the beginning of the trade of the best Yorkshire Irons, now so famous for their qualities through the entire civilised world.

The Bowling Iron Works may properly be considered, therefore, as the pioneer of the great prosperity which has rendered Bradford famous amongst the commercial marts of the world. The population of the borough when the Bowling works were started would only be about 10,000, as thirteen years later, in 1801, it was not more than 13,264, whereas the present population is over 150,000. The establishing of works of this kind, at which employment for a considerable number of men would be insured, must at that period have been regarded as an event of much importance. John Sturges, of Sandal, Wakefield, an Ironmaster of repute, was the first to broach the establishing of Iron works on ground where they now stand, and to his knowledge of the necessary minerals to produce a superior Iron is to be attributed the choice of the situation.

The engine originally erected for blowing purposes was burnt down a few years after it had been at work, and was replaced by the one called the 'Old Blast Engine,' now existing. This was considered to be a great improvement upon the first one, as the valve gear was made self-acting. Below the engine, and constructed in massive masonry work, was made the air

chamber for equalising the pressure of the blast. A bar mill and a plate mill were started soon afterwards, and were also driven by a steam engine, a considerable portion of which was constructed on the spot. We find it stated in 'Smiles' Lives of Boulton and Watt' that notice was given to the Bowling Iron Works, near Bradford, of proceedings against the company for the recovery of dues. On this the Bowling Company offered to treat, and young Watt went down to Leeds for the purpose of meeting the representatives of the Bowling Company on the subject. On February 24, 1796, he wrote his friend Matthew Robinson Boulton, as follows:-- 'Enclosed you have a copy of the treaty of peace, not amity, concluded at Leeds on Saturday last between me, Minister Plenipotentiary to your Highness on the one part, and the Bowling Pirates in person on the other part. I hope you will ratify the terms as you will see they are founded entirely upon the principle of indemnity for the past and security for the future.' On referring to the private ledger of these works of that date, we found that the treaty of peace referred to was purchased at the price of 1,640l.

The sub-stratum around Bowling is part of the most extensive and valuable coalfield in England, stretching from Derby or Nottingham to this district, a distance of sixty miles, and ranging about eight miles broad. The seam of coal called the 'better bed,' which is one of the valuable elements necessary for the production of the best quality of Iron, is seated upon a peculiar hard silicious sandstone termed 'galliard,' immediately above the black bed coal, and resting upon it is an argillaceous

stratum of the mean thickness of two yards, in which lies embedded in irregular layers the valuable ironstone of this district. The stone wears a dark brown appearance, and yields about thirty-two per cent. of Iron. Both coals are caking coals and moderately hard. The ash of the black bed coal is of a dark purple gold colour, similar to roasted pyrites. This coal contains a very large percentage of pyrites in a state of intimate mixture in the coal, so that it cannot be seen; the ash fuses readily, is slightly alkaline (due to lime), and containing sulphide of Iron and a very large quantity of oxide.

The works comprise six cold blast furnaces, from which about 360 tons of pig Iron are run per week, five refineries, twenty-one puddling furnaces, forty heating furnaces, an extensive forge, a tyre mill for rolling steel and Iron weldless tyres, one guide mill, one bar mill, with 15 in. rolls, and two plate mills. A third new plate mill is nearly completed. The powerful reversing engines to give motion to this mill are on the principle introduced by Mr. John Ramsbottom, late of Crewe works, and when the mill is completed plates can be rolled of the largest superficial area ever yet attempted.

There is also an extensive steel works for making crucible steel, having about 100 pot furnaces, and which is now in process of extension and improvement by the erection of new furnaces on the Siemens and Siemens-Martin principle, to be worked by Siemens' regenerative gas furnaces. The engineering works comprise foundry, smithy, boiler-fitting, millwright, wheelwright, and fitting shops.

### [154] THE BOWLING IRON COMPANY AT BRADFORD.

The Bowling Company itself supplies almost all the coal and ironstone which it consumes, its collieries extending five or six miles in various directions, and the main pits being connected together and with the Iron works by tramways worked with wire ropes. total length of these tramways is 21 miles, the number of pits 42, and the number of hands employed in them is more than 2,000. To work the pits 61 steam engines are required, having cylinders varying from 7 to 70 in. in diameter, and to supply them with steam 81 steam boilers are required of from 10 to 50 horse power each. In the Iron Works are three blast engines, with blowing cylinders, varying from 76 to 84 in. in diameter, and fourteen engines of from 20 to 60 horse power, to give motion to the various machines, besides numerous small engines driving separate machines and pumping water for the boilers. The number of steam hammers is thirteen, and helve hammers two. The supply of steam is maintained by thirty-three boilers of from 20 to 50 horse power each. The number of hands employed at the Ironworks is upwards of 1,000, thus making a total of upwards of 3,000.

The yield per cent. on the raw ore is 32 per cent. iron, and on the calcined ore 42 per cent. iron. The following are the relative quantities of minerals for producing 1 ton of Bowling pig Iron:—Raw ore, 3 tons 3 cwt. 3 qrs. 27 lb.; calcined ore, 2 tons 7 cwt. 1 qr. 26 lb.; limestone, 18 cwt. 2 qrs. 12lb.; coke, 2 tons 5 cwt. 0 qrs. 9 lb. The quantity of pig Iron used to produce 1 ton of bar Iron (finished) is 1 ton 12 cwt. 1 qr. 25lb. The limestone is obtained from Skipton, and is called

locally 'Skipton old rock.' The sulphur in all the samples varies only very slightly, and may in fact be considered identical, the difference in the results not being more than those due to the errors of experiment. The phosphorus in all the samples exists in precisely the same quantity, the whole of this element present in the ore combining with the Iron.

I have made a sketch of the original blast furnace at Bowling, now in existence and working to within two or three weeks, presuming it might be interesting to some of the members of the Association. I have been told by some of the oldest inhabitants of Bowling, that there was only one tuyere at first, but two have now been used for many years, the nozzles being  $2\frac{3}{4}$  in. in diameter, and the pressure of blast supplied to this and the other furnaces 32 oz.

The Iron for plates and bars is taken direct to the refineries or oxidising hearths. The metal is placed upon the hearth, covered with coke, and a blast is forced over the surface. Two tons of refined or plate metal are produced from each charge, which is run into moulds cooled by water, the refined metal being about 2 in. thick, and 12 ft. long by 4 ft. broad. From the refineries the plate, or refined metal, is taken to the puddling furnaces for conversion into malleable Iron in the usual manner, by charges of about 3 cwt. at a time, and each puddling furnace is charged ten times a day. The quality of the Iron necessitates more attention from the puddler than the commoner classes of Iron, and to insure the extra attention and a uniform quality a premium is given to the puddlers who have produced the

## [156] THE BOWLING IRON COMPANY AT BRADFORD.

best specimens during a turn. The puddled Iron is taken under the steam hammer to knock out the slag and impurities, and is made into what are called 'stampings' and 'nobblins.' The stampings are broken into several pieces under fall-hammers, piled, heated, taken under a steam hammer, and made into blooms, or billets, in which state they are taken to the bar or guide mill, re-heated, and rolled into round or square bars, angle irons, rods, or such other shapes as may be required. The nobblins are piled, heated, taken under the steam hammer, and made into blooms, or slabs, of various sizes, and afterwards to the platemill, where they are re-heated and rolled into plates.

From stampings are made the Bowling Iron weldless tyres. A hole about 5 in. in diameter is punched through the centre of the bloom, forming it into a ring of Iron. The ring thus made is hooked on the beck of an anvil, and is hammered with a suitably shaped hammer head to raise up the flange, the ring being constantly rotated on the beck between the blows of the hammer, so that all parts may be evenly worked. At the end of this process the ring begins to have some resemblance to a tyre, and is then rolled out.

The steel works were erected in the year 1866, and the steel manufactured is crucible steel, produced in the ordinary manner in furnaces heated by coke. The Iron used is scrap from Bowling plates, and its conversion into steel is effected by the addition of suitable quantities of carbon, chiefly introduced by spiegeleisen, and also by a mixture of steel scrap. Of the steel produced, a part is used for making tyres from ingots, in

a similar manner to Iron tyres and general forgings; and a considerable portion is used for making castings of all descriptions, where strength, with lightness, is the desideratum. Arrangements are now being made, and are partly completed, for applying Siemens gas process for melting the crucible steel in suitable furnaces; and a Siemens-Martin furnace is also in course of erection for the conversion of pig Iron into steel; the furnace will produce four tons of steel at one operation.

The engineering is done in one extensive range of buildings, where the whole of the work and new plant required to keep the collieries and works described in repair are made. This department is also devoted to the construction of engines, &c., for the market. In the model-room—one of the finest in the country—is a model from which the first wheel was cast for Blenkinsop's locomotive. The boiler shop is now being extended so as to be capable of producing from two to three boilers per week. The foundry has been recently rebuilt upon the old site.

The distinguished qualities of the Bowling Iron are hardness with great pliability, homogenity and uniformity of texture, capability of withstanding the action of fire, and receiving a brilliant polish, it being used extensively in the Sheffield trades on account of the last-named virtue. Works established in the infancy of the Iron trade and producing a superior quality of metal—quality being always preferred to quantity whenever the alternative presents itself—must naturally be disposed to conservatism. Besides repeated experiences have proved the necessity of keeping to the

original mode of working with the minerals and Iron. It is rarely known to what purpose or tests the Iron may be put to on leaving the premises, but it is known that it will have to withstand usage such as no common Iron or any other Iron but charcoal Iron perhaps could do, and it was for the latter that the Bowling Iron was originally manufactured as a substitute. Keeping in view the production of an uniform quality, changes of whatever description have been jealously regarded, and those that have been made have only been arrived at by very gradual stages.

Mr. H. W. Ripley, on behalf of the Bowling Iron Company, said that the works were started in the latter part of last century by three gentlemen, who each subscribed £5 for the purpose of testing the quality of the Iron ore which was found there. They had a few years ago expended over £12,000 in new engines, which had paid for themselves in eighteen months by the economy effected.

## PARTICULARS OF THE LILLESHALL COMPANY'S WORKS, IN SHROPSHIRE.

Engineering Department.—In the machine shops there are upwards of 70 tools, consisting of lathes, screw-cutting and surfacing; large wheel lathes and face lathes; powerful planing machines; side planing machines for facing large cylinders and steam hammer standards; slotting, drilling, and shaping machines of various sizes; radial drills; cotter-hole drills; bolt and nut-screwing machines; cylinder-boring machine;

## STATISTICS OF THE LILLESHALL COMPANY'S WORKS. [159]

also vertical apparatus for boring cylinders up to 120 in diameter. Most of the tools are by eminent makers, and are of the newest designs.

The machinery is driven by a pair of wall engines and by two horizontal engines.

The erecting shops are spacious and well-lighted, and are so arranged with regard to the machine shops as to reduce to a minimum the labour of transporting the materials.

There are now in progress six locomotives, nine blast engines of various types, heavy pumping and winding machinery, steam hammers, &c.

In the smithy there are two steam hammers, one, recently-erected, being the American dead-blow hammer. The smiths' fires are blown by a noiseless fan.

The foundry is specially arranged for the making of heavy castings, and is well supplied with cranes—swivel and overhead travelling. There are facilities for making castings up to thirty tons.

The fitting, erecting, and machine shops cover about an acre of ground.

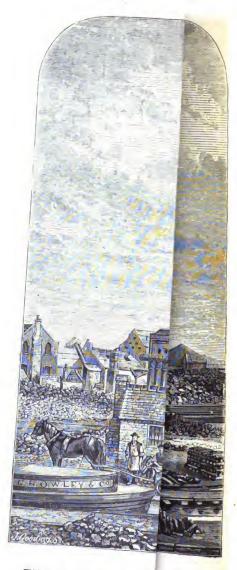
General Remarks.—The Company raise annually about 400,000 tons of coal and slack, 105,000 tons of clayband ironstone, and 5,000 tons of fire-clay for bricks.

The number of persons employed in the mines, at the furnaces, and the engineering establishment is upwards of 3,200. This Company has nine blast furnaces, capable of making from 70,000 to 75,000 tons of pig iron per annum, of the very best quality.

## IMPORTANT HINTS AND INFORMATION FOR IRONMASTERS AND MERCHANTS.

The comprehensive List of Buyers of Iron, which commences at page 223, conveys valuable information.

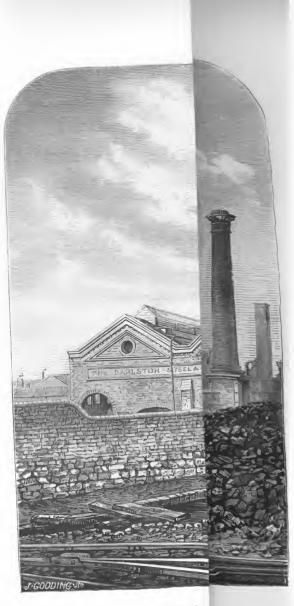
It is just as well to inform the reader that the author is the Editor of the 'London Iron Trade Exchange,' the oldest metallurgical publication extant, the 'Mining Journal' excepted. The 'Exchange' was published as early as 1849, under the name of the 'Iron Trade Circular.' In March, however, of this year (1873), under the advice of Sir James Malins, one of Her Majesty's Vice Chancellors, the name was changed from the 'Iron Trade Circular' to the 'London Iron Trade Exchange,' edited by the Author. It has always been a subscription paper, and remains so, price 2l. 2s. per annum in advance; therefore, any Subscriber to the 'Exchange' is entitled to have all information from the Editor in respect to the Iron Trade, in answer to enquiries, free of all charge. Every name in the list, to a Subscriber, might be made subject to our own reply in regard to respectability, standing in the City &c., &c.; besides, we may here remark that the Subscribers to the 'Exchange' have a right to ask for and receive information direct from the Editor upon all and every matter connected with the Iron Trade within the range of the Editor's own knowledge, free of charge;



THE DARLASTON STNDRIES.

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but it must be clearly understood that all answers in respect to standing and respectability of merchants must be treated confidentially, Mr. Griffiths' personal knowledge on the latter subject being varied and extensive, both in London and the Iron districts.

It may further be added that the letters on all subjects from Subscribers are answered promptly by Mr. Griffiths' personal dictation. The Editor takes pride in furnishing this information.

#### THE DARLASTON STEEL AND IRON COMPANY

Is one of the very oldest in South Staffordshire, and has always had a name for a good quality of iron. All sizes of iron are made here, including hoops, strip, tank plates, boiler plates, small sizes of rounds and squares, for the quality of which these works were noted in Bills' and Mill's times who established the works.

The Darlaston Steel Company likewise convert steel on a large scale on the cementation process. All kinds of steel are made here and the brands are well known and appreciated in the market. The company have three blast furnaces, extensive puddling furnaces, and rolling mills both here and at Wednesbury; also valuable iron-stone and coal mines, having large quantities of coal over and above their own consumption, which are disposed of in the open market.

These extensive works were established by Bills and Mills. We believe they commenced about 1814, or [7 2]

earlier. At the death of Mr. Samuel Mills, a company composed mainly of the Lloyd family purchased the concerns, adding to them the King's Hill Iron Works, well known for its boiler plates.

The Darlaston Steel and Iron Company have recently erected one of Brown's patent mills at considerable expense. This is the only mill of the kind working in Staffordshire. It is capable of rolling enormous quantities of strip of great lengths, the rolls being so arranged under Brown's patent as to complete the operation with very little manual labour, the piece being conducted by the power of the machinery into a second pair of rolls which completes the work. They have likewise at work here two of Casson's patent puddling furnaces with Griffiths's puddling machine, which, we understand, work well together. Casson's furnace is generally well thought of in this district.

This is one of the largest and most important concerns in Staffordshire, and as all the mines and coal in this locality are of superior quality, the Darlaston Steel and Iron Company have no difficulty in keeping up the high quality of iron always made at these works.

Mr. Sampson Lloyd, Wassel Grove, Stourbridge, late of the old Park works, is the Chairman of the company. Mr. Francis Lloyd is the managing director.

This company has forty-three puddling furnaces, and seventeen reheating furnaces, three blast furnaces, three blast engines, seventy horse power each (altogether they have sixty-three steam-engines), eight rolling mills and a drawing-out forge for all kinds of use iron and



ONE OFRNACES, AT DARLASTON.

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TILDEN FOUNDATIONS

steel. They make rails, wire rods, and all other kinds of iron.—Rails are laid down to all parts of the works. They have a self-tipping apparatus on the mine banks of the furnaces. Also extensive collieries and mines, 850 acres in all, 350 freehold and 500 leasehold, besides 55 acres of thick coal 12 yards thick. Their property contains the Brooch coal, the Heathen coal, and various other seams, the new mine stone, the rough hill white stone, the Gubbin and shales and blue flats.

This firm make channel iron and rails and sell in the open market very large quantities of coal. Besides their own pig iron which is of high Staffordshire quality, they purchase and consume as a mixture Lilleshall from Shropshire, and Barrow pig from Lancashire to mix with their own make. Name of managing director can be give at office, 84, Cannon Street.

#### THE ALBERT AND MOXLEY IRON WORKS.

The former of these works were built twenty-one years ago, and have since been carried on by Mr. David Rose. The Moxley Works, which were formerly carried on by Messrs. Daniel and David Rose, were founded in 1830, but on the occasion of Mr. Daniel Rose retiring from business a few years ago, the whole of the property was acquired by his youngest brother, Mr. David. These works are justly celebrated for the manufacture of use iron forgings and charcoal sheet iron.

The Victoria Works are famed for the manufacture of all kinds of strip iron, notably that for locomotive and boiler tube purposes.

The Albert Works, like Mr. William Rose of Batman's Hill, stand well in the market for plates and sheets, and the firm have a good old connection with engineers and machinists at home and on the Continent of Europe. Two blast furnaces have recently been built here on most modern principles, and acknowledged to be the finest plant in the South Staffordshire District, and capable of turning out 20,000 tons of pig iron per annum.

Mr. Rose has extensive galvanizing works here, and carries on the trade on the same premises to a large extent. Although Mr. Rose is an old ironmaster, his judgment in mines is very sound. On more than one occasion he has purchased valuable mineral property in the Black Country, and sold it at a large profit.

It may be interesting to note that near the works is a valuable sand mine, largely used for blast furnaces and mill furnace bottoms. It will thus be seen that whilst the sand in being excavated forms a nice little revenue, it is a valuable adjunct to the works for the deposit of cinders and ashes.

The mines of coal and ironstone here, and at an adjoining colliery of about 100 acres in extent, are also very prolific. Clay for the manufacture of fire-bricks, is also raised, and the quality is very superior. It is estimated that there is sufficient coal for the supply of the works for at least twenty years.

This is a most unique and valuable property, for Mr. David Rose, of Moxley, digs his own coal, sand and fire clay, makes his own pigs and fire-bricks, puddles his own iron, makes and galvanizes his own sheet iron, and, we believe, raises a large portion of the ironstone to make the pigs. We can safely say there are no other works in England, or the world, which can boast of the same products and advantages on one and the same spot, stretching over an area of comparatively only a few acres of ground.

The works, which are connected with the London and North-Western system, are entirely surrounded with a high brick wall, and are exceptionally convenient and well laid out. In all there are 40 puddling and ball furnaces, 5 sheet mills, 1 plate mill, 1 strip mill, 1 bar mill, and one hoop mill. The pig iron made here is good. Indeed all the iron made at the Moxley Works, including their galvanized sheets, stands high in the London market.

## HISTORY OF PUDDLING, BEGINNING WITH HENRY CORT.

Puddling, in the sense used in connection with malleable iron making, requires the exercise of very trying manual labour. Both shingling and rolling test severely the muscular power and adroit manipulations of these iron-workers. Some think the collier and the miner have a trying and a severe physical task in the bowels of the earth. This may be so; we are of opinion, however, that the physical power and endurance exercised by the puddler to make a 'heat' of good iron is greater, and taxes the muscle and strength of the operator to a much greater extent than the shingler, the roller, collier, or any other workman engaged in the coal and iron trades, particularly if the puddler is bent upon doing his work well, so as to produce a proper yield and good For the attainment of these desiderata good puddling is a sine qua non. We will not attempt to describe the process further than to say that for threequarters of an hour the puddler has to face the molten metal, continually agitating the same in consecutive order over this boiling sea of metal and silica, which is so bright with the high state of calorific fluidity necessary for the successful process, and the workman being within a yard of the stopper-hole of the furnace, that and the meridian sun-like glare of the metal upon the eyes are almost overpowering. Nevertheless, he must work away until his iron comes into 'nature;' his exertions and the high temperature, particularly in the summer time, cause perspiration to such an extent that the puddler of necessity has a towel always ready to remove it. His final operation is to take the 'heat' in four, five, or six pieces, called 'balls,' previously formed in the furnace, to the hammer, where the iron is compressed and consolidated by heavy blows, which at the same time, drive the dross or cinder out of it, and in this way it is prepared for the rolls. The puddler now has breathing time; his work is light for an hour; his only next duty is to assist in re-charging the furnace and quietly recuperate his strength for the next 'heat,' which will be melted ready for him in another hour or so.

The first puddling furnace was invented and constructed by Henry Cort about the year 1793, for which this pioneer iron-master took out a patent. His furnace was reverberatory; the bottom was made of sand; and although Cort's plan was very imperfect, and almost useless for making good iron, his invention of groove rolls about the same time, to co-operate with his new system of puddling, gave a great impetus to the iron trade in these kingdoms. The iron made from the pig, however, by Cort, was brittle, and wanted the fibre and strength which were afterwards supplied to the metal to some extent by the introduction of the refinery, which enabled the ironmasters of the United Kingdom, in a few years, to make sufficient iron for our own native consumption, which had previously been imported from Russia and Sweden at very high prices. The refinery, it may be remarked here, was a faint attempt in effect at Mr. Bessemer's wonderful process, although the inventor was ignorant of the causes which produced some good effect on the iron. The difference in the processes was great. The old refinery drove a blast of atmospheric air on to the molten iron for a short time after it was melted, which, to some extent, decarbonized it; Mr. Bessemer, however, injected large volumes of atmospheric air at a much higher pressure into the very heart of the molten metal, and by this

means ministered oxygen ad libitum to the utter destruction of all the carbon contained in the metal. Mr. Bessemer afterwards, by the addition of spieglesen. adds to the iron or steel, whichever is intended, the exact quantity of carbon required for the iron or steel, while in a molten state.

By the above it will be perceived that our fore-fathers, although ignorant of metallurgical art, and in the absence of scientific knowledge, accidentally developed a part of Mr. Bessemer's principle. This is a short description of the first puddling furnace and refinery, and although we can say but little in favour of this puddling furnace, Mr. Henry Cort left a legacy to the iron trade, in his invention of groove rolls, which cannot be too highly prized, and will always render the name of Henry Cort famous in the annals of the iron trade.

About the year 1825, sand-bottom puddling furnaces began to be abandoned in favour of what were then called 'iron bottoms.' Various silicates and oxides of iron were melted on the plates to make the bottoms and for fettling. This plan was adopted for some years, and to distinguish it from what we must call Mr. Joseph Hall's invention we shall call this the wet or water process. At a certain point of the heat, while the 'fore-hand' was puddling after the iron was melted, the 'underhand,' with a dish properly constructed for the purpose, threw water, viâ the 'stopper-hole,' upon the molten iron—about three half pints at once, the 'fore-hand' puddler frequently calling out, 'Water,

water,' as he thought it was required. What was called the drying process now commenced. The damper was dropped, and with the 'paddle' the puddler turned and returned the iron over in all parts of the furnace for some time, until the whole was properly disintegrated into a kind of powder, and was moved about until it became something like rough sand, though not so fine. Then the 'damper' was pulled up, the word 'fire' was given by the puddler to the 'underhand,' the calorific power was increased rapidly, the iron became bright in the furnace, and, as its malleability and adhesiveness were gradually established, the puddler separated the iron, rolled it up into 'balls,' and with his tongs gaily dragged it to the helve. This was the old process.

The present boiling process is too well known to require a lengthened description here. It was discovered and invented by the late Mr. Joseph Hall, one of the partners at the great Bloomfield Works at Tipton, and from that day to this has been universally adopted, not only in the United Kingdom, but in all parts of Europe and America.

Briefly, Mr. Hall's process consists of boiling<sup>1</sup> the iron, not roasting it. Under the old plan the pigs lying on the bottom of the furnace were subjected to the action of the cutting flame passing over them more on the top part than the bottom of the charge of pig metal. On this account the upper portion of the pigs, particularly

<sup>&</sup>lt;sup>1</sup> See Mr. Hall's book, which minutely describes this important invention.

the very highest part, became melted before the bottom; and as the action of the caloric was more intense upon this portion of the iron by the passing flame, ab initio, the puddler had to watch the process, and, by means of his paddle, remove the more extreme incandescent portions, or turn the pigs over, in order that, by the uniform application of the accumulating caloric, the whole mass by these mechanical means might be rendered uniformly incandescent, and finally thoroughly But during this irregular action of the fire on the metal, one portion of the iron became liquid before the other was thoroughly melted, and, as the heat was constantly increasing, great waste occurred by evaporation before the whole was properly melted, not-withstanding the greatest care on the part of the puddler. Mr. Hall's process, however, introduced boiling in silica. Here the iron is protected by the molten bath of silica which covers it, and although more intense heat can be applied to the iron through this molten sea of silica which envelopes it, the cutting flame which continually passes over the furnaces spends itself upon and is absorbed in the cinder and iron, without burning or damaging the iron. While the iron is in this boiling state it is the duty of the puddler to agitate and puddle it, and, by all the means in his power, to facilitate the elimination of the carbon, the exit of which is seen plainly enough by the globules constantly rising on the top of the molten cinder until the iron comes into 'nature.' This is, we believe, a correct, though short description, of Mr. Joseph Hall's boiling

process; for further particulars see Mr. Joseph Hall's book.

By this process uniformity in quality is obtained, waste is avoided to a considerable extent, and a quality of iron produced from the pig by the puddling process never attained by Ccrt's process or the intermediate 'iron bottoms' and water. It will be observed that the calorific power of the puddling furnace can only be kept up by the constant passage of volumes of flame over the iron in the well of the furnace. This necessitates a large consumption of fuel, and as coal is nearly treble the price it was, the cost of fuel now has become the great consideration, and unless some method can be adopted to economise the use of coal in puddling, it has become a grave question, in view of cheap coal in America, whether we shall be able to hold our position as the greatest iron producing country in the world. be observed that the flame-in fact, the whole calorific power-is constantly passing at a rapid pace over the iron, finally to be wasted and lost, for it merely leaves a portion of its calorific influence in the iron, and by the draught of the furnace is constantly carried into the open atmosphere and lost. Various patents have been taken out, the most important being Mr. Dank's, Mr. Siemen's, and Mr. Casson's. As the great object to be attained is to save labour and fuel, and make a superior quality of iron, whichever of these three patents is most adapted to produce these results must and will be most generally used, and confer the greatest benefit on the ironmaster, the puddler, and the world at large; for it

cannot be denied that the consumption of iron is so interwoven with the material and social progress of the age, that any amelioration in the cost of its production will be a blessing to mankind generally.

We went down to the Round Oak Works with a view of witnessing Mr. Casson's patent process, and have given the result of our observations for the information of our readers. The same account will likewise be found in the 'London Iron Trade Exchange,' No. 749, page 868.

THE BILSTON IRON COMPANY; THE FACTORY,
DEEPFIELDS AND STONEFIELD IRON
WORKS, BILSTON.

Messrs. Chambers and Sankey some years since commenced business, as most successful iron-masters have done before them, in a very small way at the Factory Works, but as years rolled on they have added the Stonefield Works and the Deepfields Works to the Factory: they therefore have the Deepfields Works, the Stonefield Works, and the Factory, which is thoroughly renovated and considerably enlarged. We ran through all their works, and were pleased with the arrangements of one and all.

At the Deepfields they have facilities for making sheets and boiler plates equal to any other works in the neighbourhood. The quality of the plates here is good, the sheets are well annealed, and the shears being of the most modern type, plates and sheets are turned out at the Deepfields, not only of very good quality, but in a clean and handsome condition. At the Factory works, sheets of thin gauges are made, including doubles and Satten, Canada plates, dish-plates, etc., the machinery being well adapted to this kind of iron.

At the Stonefield Works, hoops, bars, and small rounds and squares are manufactured.

This firm have in all thirty-two puddling furnaces, and have a good name for the quality of the iron they produce, and are capable, we believe, of turning out as much sheet iron as any house in Staffordshire. They make Best Best Best and charcoal sheet iron, and all descriptions of boat and boiler-plates, Canada plates, dish-plates, chequered plates, hoop iron, bar iron, small rounds and squares, &c., &c. They raise their own coal. The partners are all practical Iron-masters, and give constant personal attendance and supervision over these important works.

We annex an engraving of one of the three works belonging to this firm hereto. It is the smallest of the three. All these works are situated in the very centre of the best coal district; each are within very few minutes' walk of a railway station. Head office at Stonefield Works.



#### CHAPTER XXI.

#### SPIEGELEISEN, ITS USE AND MANUFACTURE,

Which has become quite indispensable for the Bessemer steel process, has been for a long time made at the iron-works of Schisshyttan, near Smedjebakken in Sweden, from magnetic iron ore containing 13 per cent. of manganese, with English coke, and, though fuel is very costly, the smelting pays well, the mine being close to the top of the furnace. This property last summer was transferred to the hands of some German capitalists. The principal locality, however, from which spiegeleisen is derived is the county of Siegen, in Prussia, where very fine steel ores, carbonates, and hydrates of Iron, with a large percentage of manganese, are produced at Stahlberg, Brüche, and Wilderman, near Müsen, Baudenberg, Einigkeit, and Kunst, near Burbach, and Storch, and Schöneberg, Honigsmund, Eisenzeche, Alter Hamberg, Gilberg, Grimberg, Flossberg, Driesbach, Grauebach, and others near Siegen. All these ores are calcined in kilns before being smelted with charcoal, or coke, or both mixed, for spiegeleisen, steel pig, or Bessemer pig. When smelted for spiegeleisen the charge is composed of 1,700 lbs. of calcined Siegen ore, 600 lbs. red hæmatite, 1,000 lbs. limestone, and 1,500 lbs. coke or charcoal, and it is produced at an average cost of 5l. 15s. per ton of 1,000 kilogs. When steel pig for puddling steel is made from it, the burden consists of 1,150 lbs. of Siegen ore, 800 lbs. red hæma-

tite, 350 lbs. tapcinder, 1,000 limestone, and 1,250 lbs. coke, and it is produced at an average cost of 4l. 17s., and is a very clean white forge pig. For the production of dark grey Bessemer pig the mixture is made of one-third Siegen ore, one third red hæmatite, and one-third specular iron ore, which is found in that country of excellent quality. The charge is fluxed with a large quantity of limestone, say about 42 per cent., and requires from 100 lbs. to 200 lbs. of coke more per ton than spiegeleisen. The smelting temperature is kept very high. The pig Iron, when in a liquid state, shows on its surface a peculiar change of groups of figures, which is the characteristic of spiegeleisen, and is the first indication of crystallisation. The slag is, outside, in a vitreous state of bluish or violet colour, with a more stony or crystalline interior of a yellowish brown tint. The cost of producing Bessemer pig is 6s. to 7s. per ton less than for spiegeleisen.

Spiegeleisen is used in the manufacture of Bessemer steel, being added on the termination of the blowing process to supply the requisite quantity of carbon to the pure molten metal for its conversion into steel. The Weardale Company and the Ebbw Vale Company manufacture this article. The wants, however, of the converters in this country are mostly supplied by foreign makers.

The Weardale Company, we know, have most valuable deposits of Spathic ore, admirably adapted for its production, and produce a beautiful specimen of spiegeleisen, superior to any foreign yet introduced. These are the only two firms in the United Kingdom able to make it.

### CHAPTER XXII.

#### PIG IRON MANUFACTURED IN 1871.

IRON ORE.—The total quantity of Iron Ore raised in the United Kingdom amounted to 16,334,888 tons 14 cwt.

Foreign ores imported			324,034	tons.
'Burnt ore' imported		•	200,000	,,
	Total		524,034	,,

Total of Iron ore returned as smelted in Great Britain 16,859,063 tons.

Value of the Iron ores of the United Kingdom, 7,670,5721.

Number of furnaces in blast, 673.

# Pig Iron produced :-

In England			4,379,370	tons.
" Wales .			1,087,809	"
" Scotland	•		1,160,000	,,

Total production of pig Iron in Great Britain 6,627,179 "

This quantity, estimated at the mean average price at the place of production, would have a value of 16,667,947*l*.

Summary of Pig Iron produced in 1871.

Countries	No. of Iron Works Active	No. of Furnaces built in District	No. of Furnoces in Blast	Tons of Pig Iron made
ENGLAND.				
Northumberland	2	10	3	34,165
Durham	1.0	61	473	759,244
Yorkshire, North Riding	177	75	70	1,029,885
West Riding	0	39	25	114,549
Derbyshire	12	46	38	270,485
Lancashire	7	41	34	520,359
Cumberland	1 0	34	283	336,569
City 11	10	25	19	129,467
!	7	35	30	268,300
	5.9	163	18	725,716
	- 5	12	9	60,512
	2	7	4	30,122
Lincolnshire			-	
Gloucestershire	1 6	18	13	99,997
0 11	.   (	1 .0	1	00,000
Somersetshire	160	566	4291	4.379.370
WALES.	.	1		1
	1			
NORTH WALES.	3	8	5	41 000
Denbighshire		8		41,893
South Wales.	1			
Anthracite Furnaces	. 2	19	8	34,761
BITUMINOUS (Glamorganshire	15	72	53	510,087
COAL Brecknockshire	1	14	4	30,086
DISTRICTS. Monmouthshire	11	62	47	470,982
Total .	. 32	175	117	1,087,809
SCOTLAND.			1	
Avrshire	. 7	43	35	
Lanarkshire	. 13	92	79	
Fifeshire	. 2	6	3	
Linlithgowshire	. 2	6	4	
Stirlingshire	. 2	7	5	1
Haddingtonshire	. 1	1	1	
Argyleshire	. 0	1	0	
Total .	. 27	156	127	1,160,000
	Tot	al as abov	е	6,627,179

General Summary of the returns of the Mineral Produce of the United Kingdom received by the Mining Record Office for 1871.

Number of Mines	Mineral	Quantities	Value
	*	Tons cwts.	£
2,760	Coal	117,352,028 0	35,205,608
210	Iron ore 1	16,334,888 14	7,670,572
122	Copper ore	97,129 0	387,118
145	Tin ore	16,272 0	1,030,834
241	Lead ore	93,965 17	1,155,770
47	Zinc ore	17,736 10	56,330
332	Iron pyrites (sulphur	,	
	ores)	61,973 0	64,987
1	Silver ore	5 0	421
16	Arsenic 3	4,147 15	15,519
9	Gossans, ochres, &c	697 5	1,396
1	Wolfram and tung-		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
	state of soda	20 0	228
1	Nickel	2 0	98
1	Bismuth	2	14
2	Fluor spar	51 10	26
24	Manganese	5,548 1	22,958
1	Cobalt ore	3 0	120
	Barytes	5,512 8	3,539
	Clays, fine and fire	,,,,,	-,
	(partly Estimated).	1,255,000 0	475,000
	Earthy minerals (Es-	2,200,000	2.0,000
	timated)	_	600,000
	Salt	1,505,725 0	752,862
	Coprolites (Esti-	_,,,	,
	mated)	36,500 0	51,000
	Total Value of the Mining the United King		47,494,400

<sup>&</sup>lt;sup>1</sup> It has not been possible, in every case, to determine whether the return of Iron Ore has been for calcined or uncalcined ores. The actual production of 'Raw Ore' will probably be in excess of this quantity. Estimating the quantity of pig Iron made at 2<sup>3</sup>/<sub>4</sub> tons of ore for each ton of Iron, and deducting the Foreign Ore, 'Burnt Ore,' and 'Cinder' used, the quantity will be about, or slightly above, 17,000,000 tons.

<sup>&</sup>lt;sup>2</sup> Beside those mines, some collieries produced Pyrites, 'Coal Brasses.'

Beyond this a quantity of Arsenic is produced by smelters, of which no return is obtainable.

# IRON AND OTHER METALS SMELTED IN THE UNITED KINGDOM IN 1871.

Metals obtained from the Ores enumerated, &c., in the United Kingdom in 1871:—

Description of Metal					Quantities	Value	
Pig Iron				Tons	6,627,179	£ 16,667,947	
		•		1005			
		•	•	"	6,280	475,143	
Tin .				,,	10,900	1,498,750	
Lead .				,,	69,056	1,251,815	
Silver				Ounces	761,490	190,372	
Zinc .				Tons	4,966	92,743	
Other Me	tals	(Estin	mate	d) .	_	3,000	
Total V	alue	of M	leta.	ls produce	ed from the		
				Kingdom i		20,179,770	

Total Value of the Metals produced which are not smelted, Coal and other Minerals raised in 1871:—

							£
Metals,	value of	as ab	ove.			•	20,179,770
Coal	"	. ,,					35,205,608
Minerals, earthy, &c.						1,936,515	
			Tota	l valu	e.		57,321,893

In this gross sum of 57 millions sterling, neither building stones, lime, slates, or common clay and brick earths are included.

# IRON ORE PRODUCE.

# General Summary of Returns.

Counties, &c.	Quantities	Value
	Tons cwts.	£ s. d.
Cornwall	21,947 14	11,509 8 3
Devonshire	14,124 14	6,095 16 0
Somersetshire	32,883 13	32,883 13 0
Gloucestershire	207,598 16	155,060 0 0
Wiltshire	159,894 0	27,989 0 0
Oxfordshire	28,330 0	21,247 0 0
Northamptonshire	779,314 3	133,155 18 0
Lincolnshire	290,673 9	50,705 0 0
Shropshire	415,972 0	157,083 0 0
Warwickshire	34,075 0	15,570 0 0
Staffordshire, North .	1,513,080 0	921,022 0 0
South	705,665 0	453,512 0 0
Derbyshire	492,973 0	295,782 0 0
Lancashire	931,048 0	1,163,810 0 0
Cumberland	1,302,703 15	1,448,975 0 0
Yorkshire, North Riding.	4,581,901 0	1,144,974 2 0
West Riding .	407,997 0	101,998 10 0
Northumberland and		
Durham	285,297 0	71,349 0 0
NORTH WALES	51,887 0	23,348 0 0
South Wales and .		
MONMOUTHSHIRE	969,714 10	543,422 16 0
ISLE OF MAN	75 0	37 10 0
SCOTLAND	3,000,000 0	825,000 0 0
IRELAND		
IRELAND	107,734 0	66,043 0 0
Total Iron Ore Produc-		
tion of the United	16,334,888 14	7,670,572 13 8
Kingdom	20,002,000 22	.,0.0,0.12 20
'Burnt Ore' from Cup-		
reous Pyrites .	200,000 0	
Iron Ore Imported	324,175 0	
Lion Old Imported .	027,110	
Total of Iron Ore of		
which returns have	16,859,063 14	
been received .		

#### CHAPTER XXIII.

#### OUR COAL IN THE UNITED KINGDOM.

The Gross Quantity of Coal raised in the United Kingdom in 1872 was 121,000,000 Tons.

The coal mines of England are, without doubt, the most valuable indigenous product we can boast of, leaving any other mineral or metal produced in this country far behind in the quantity raised or their aggregate value.

Germany, Belgium, and France have coal, with extensive collieries regularly at work. The quality in these countries, in the main, is inferior to English, particularly for Iron smelting.<sup>1</sup> The export to Germany and France from this country has steadily increased over the last ten years, and during 1872 in an accelerated ratio.

The same may be said, in a lesser degree, with respect to all foreign countries depending upon England for their supply of fuel. We raised in 1872, 121,000,000 tons of coal and slack in the United King dom. According to Mr. Robert Hunt's valuable statistics the out-put of 1871 was 117,352,028 tons.

Mr. Hunt puts the gross value of 1871 at 35,201,618l.;

<sup>&</sup>lt;sup>1</sup> The coal deposits in the United States may be said to be inexhaustible; the same may be said, though in a lesser degree, with regard to the Dominion.

taking the 121,000,000 tons raised last year at 11s. 3d. per ton in trucks, boats, or F.O.B., which we think will be quite low enough, our coal for the year yielded to the coal-masters no less than 68,625,000l., which far supersedes in value the tea of China, the cotton of America, the wines of France, the diamonds of Golconda, or the native produce of any single article in any other country in more southern climes, where the genial influence of the sun so materially assists the labour of man in bringing forth corn, wine, and the more luscious fruits of the earth. Cornwall has ministered from the earliest ages to England's requirements for tin and copper. Shropshire, Northumberland and Durham, Montgomeryshire and the Isle of Man, have distanced Cornwall in the out-put of lead, and the totals of these metals produced in the United Kingdom are highly creditable to the adventurers, but the aggregate value of all the metals raised appear insignificant when placed in contrast with the gross value of our 'Black Diamonds.

The value of the tin smelted from English ore in 1871 was 1,498,750l.; the value of the lead was 1,251,815l.; the copper was 475,143l.; the silver 190,372l.; zinc 92,743l., which gives a total of 3,508,823l. If for the advance in the price of copper and tin, which ascended most in value in this category last year, we add 500,000l., which will be over the mark, this gives us a total value for all the metals for 1872 of 4,000,000l., not a 1-16th, or one and threepence in the pound, of the total value of the coal raised in the United Kingdom; the out-put of which, as before stated, has produced to the coal-owners

no less than 66,000,000*l*. sterling. Our gracious Queen may justly boast of the gold of Australia, the precious diamonds of the Cape, the indigo and opium, and of late the cotton and jute, of India; but her vast dominions, either at home or abroad, are unable to furnish any single staple commodity or manufacture, which can compete in value and national importance with the coal annually raised in the United Kingdom. The rapid and marvellous 'jumps,' as Mr. Gladstone so cogently puts it, in the acquisition of national wealth, must be attributed in no small degree to our ability to furnish a constant supply to the world's increasing demand for this valuable mineral. generates our steam, applied first successfully by Watt's condensing engine, to give motion to the wheels and spindles of corn-mills and factories, and ten thousand other manufacturing processes propelled by the steam-engine. Steam, through the engine, is manipulating, day and night, in the Potteries, reducing bones and the hardest flint into snow-white china clay; in Manchester and Leeds, driving hundreds of thousands of spindles at speeds which would bewilder the reader to compute; indeed, steam is everywhere employed as it were to civilize and educate inanimate nature itself, converting the sand of the sea-shore into a beautiful button, the hard feltspar rock into a china teacup, and the cotton of Georgia into dresses and comfortable under-linen for the use of mankind. Coal likewise supplies the motive power to the railway, enabling us to move from one end of the kingdom to the other with extraordinary rapidity. Again, our gas owes its lighting power to coal, which

enables us to light up our towns, and contravene the inexorable laws of Nature by turning night into day, while the earth, during her diurnal rambles, for a little while would fain leave us without the smiles of the sun to light, warm and cheer us. Coal propels, through the engine, the mighty ironclads which protect our island; these are ready, by the power of steam, to dash into any port or harbour in the world to avenge our outraged honour or demand redress for England's wrongs at the hands of her enemies. Coal is the handmaid of trade and commerce: by the steam it creates our ships easily plough their way through the mighty deep to all parts of the world, gallantly steaming back into our great ports, laden with the richest and most choice products of all nations, making this country at once the depôt or grand emporium of the gold and all other produce most valued and eagerly sought after by all civilized nations.

After endeavouring to represent the vital importance of English coal to our readers, with all its surroundings in a national and commercial point of view, we will now explain and name all the counties in England, Scotland, and Wales, whence the aggregate out-put was raised last year, giving the amount for each county, and showing the degree in which they contributed to the total aggregate.

First, however, we give Mr. Robert Hunt's, F.R.S., general summary for 1871, the returns having been obtained by that gentleman in his official capacity of Keeper of Mining Records, the statistics having been published by order of the Lords Commissioners of Her

Majesty's Treasury; therefore, these 1871 returns are as perfect as it is possible to get them for the present. A careful perusal of these tables, and comparison of the out-put for 1871, both in coal, Iron, and Iron ore, the reader will be enabled to judge for himself of the estimate which we have given at the end of the tables of the out-put for 1872, which has been considerably increased.

#### LANCASHIRE.

NORTH AND EAST OR MANCHESTER DISTRICT.

Mr. Joseph Dickinson, Inspector.

The Number of Collieries, 287.

The production of coal . . . . . 7,576,000 tors.

THE WESTERN DISTRICT.

Mr. Peter Higson, Inspector.

The Number of Collieries, 89.

The production of coal . . . . 6,275,000 ..

Total of Lancashire . . . 13,851,000 ,.

#### CHESHIRE.

Mr. Thomas Wynne, Inspector.

The Number of Collieries, 29.

The production of coal. . . . 975,000 tons.

#### YORKSHIRE.

Mr. Frank N. Wardell, Inspector.

The Number of Collieries, 423.

No. of Collieries.

4 Bingley.

No. of Collieries.

31 Dewsbury.

44 Barnsley. 29 Halifax.

49 Bradford. 26 Huddersfield.

N	o. of Collieries.	No.	of Collieries.
1	2 Holmfirth.	25	Rotheram.
8	9 Leeds.	36	Sheffield.
	6 Normanton.	48	Wakefield.
	6 Peniston.	1	Saddleworth and Settle.
	7 Pontefract.		

Total of collieries, 423.

Total produce of Yorkshire, 12,801,260 tons.

NORTHUMBERLAND AND DURHAM.	
Collieries. Mr. George W. Southern, inspector, Northumber-	
land 164	
Mr. James Willis, inspector, Durham 140	
Total collieries 304	
Gross Produce sold from and used at the Collieries of Durho	ın
and Northumberland in the year 1871 :-	
Tons.	
Coal exported to foreign countries 6,230,567	
Coke exported to foreign countries 289,314 tons, computed as coal	
Coal sent coastwise 5,355,737  Coke sent coastwise, 19,005 tons, computed	
as coal	
Coal carried from this coal-field by railway 6,227,002	
Coke carried from this coal-field by railway, for local and land sale as below, 2,161,020	
Coke carried south of Altofts, 1,182,160 tons, computed as coal 1,970,266	
Coal and coke for railway use, the coke	
computed as coal	
Colliery consumption estimated 1,450,000	
Domestic consumption, and coal used in	
local manufactures 3,250,000	
Total of Durham and Northumberland . 29,190,916	

#### CUMBERLAND.

Mr. George W. Southern, Inspector.

The Number of Collieries, 27.

The production of coal, 1,423,661 tons.

# DERBYSHIRE, NOTTINGHAMSHIRE, LEICESTER-SHIRE, AND WARWICKSHIRE.

Mr. Thomas Evans, Inspector.

The Number of Collieries, 187.

The production of coal, 9,252,900 tons.

No. of Coll	ieries.			Qu	antity produced. Tons.
130	Derbyshire .				5,360,000
27	Nottinghamshire				2,469,400
18	Warwickshire .				723,600
12	Leicestershire .				699,900
187	Total of above	cou	nties		9,252,900

# MONMOUTHSHIRE, BRECKNOCKSHIRE, and the edge of GLAMORGANSHIRE.

Mr. Lionel Brough, Inspector.

The Number of Collieries, 74.

The production of coal, 4,915,525 tons.

# GLOUCESTERSHIRE AND SOMERSETSHIRE.

Mr. Lionel Brough, Inspector.

The Number of Collieries, 101.

The production of coal, 2,086,475 tons.

FOREST OF DEAN.
Coal worked in the year 1871, 837,893 tons.

# Total produce of Gloucestershire and Somersetshire :-

No. of Co.	lieries.			Tons.
66	Gloucestershire.			1,412,597
35	Somersetshire .			673,878
101				2,086,475

#### WALES.

#### NORTH WALES.

Mr. Peter Higson, Inspector.

The Number of Collieries, 58.

#### The production of coal:-

No. of Co				
32	Flintshire Denbigshire			] Tons.
24	Denbigshire			2,500,000
2	Anglesea .			]
58				

#### SOUTH WALES.

Mr. Thomas E. Wales, Inspector.

The Number of Collieries, 299.

No. of Coll	lieries.				Tons.
9	Pembrokshire .				111,000
44	Caermarthenshire				679,322
246	Glamorganshire		•	•	8,329,678
299	The production	of	coal		9,120,000

#### STAFFORDSHIRE AND WORCESTERSHIRE.

NORTH STAFFORDSHIRE.

Mr. Thomas Wynne, Inspector.

The Number of Collieries, 115.

The production of ccal, 4,300,000 tons.

CONSUMPTION AND DISTRIBUTION.	Tons.
Coal used at Iron works	1,825,000
Coal used at potteries and brick works .	760,000
Coal used at other manufactories	525,951
Coal carried by N. Stafford railway out of	
the district	241,841
Coal carried by canal (Trent and Mersey)	
navigation	356,964
Coal carried by railway to local stations for	
home use	505,244
Colliery consumption	30,000
Total for North Shields	4,250,000

## SOUTH STAFFORDSHIRE AND WORCESTERSHIRE.

Mr. James P. Baker, Inspector.

The Number of Collieries, 307.

The production of coal, 10.031.250 to

The production of coal, 10,031,250	tons.
Consumption and Distribution.	Tons.
Coal used in Iron works	3,585,750
Coal used by other manufactures	1,500,000
Domestic consumption	1,875,500
Colliery consumption and allowance coal .	1,350,000
Total used in District	8,311,250
Sent out of district by railway and canal .	1,720,000
Total produce of South Staffordshire .	10,031,250
Total coal produce of Staffordshire and Word	cestershire :—
	Tons.
North Staffordshire	4,250,000
South Staffordshire and Worcestershire .	10,031,250

Total .

14,281,250

#### SHROPSHIRE.

Mr. Thomas Wynne, Inspector.

The Number of Collieries, 59.

The production of coal, 1,350,000 tons.

#### SCOTLAND.

THE WESTERN DISTRICT.

Mr. William Alexander, Inspector.

The Number of Collieries, 204.

Tons.
The production of coal . . . . 6,554,365

#### THE EASTERN DISTRICT.

Mr. Ralph Moore, Inspector.
The Number of Collieries, 216.

Names of Inspectors	District under Inspection			
George W. Southern, Esq., 17, Wentworth Place, Newcastle-on-Tyne. James Willis, Esq., Old Elvet, Durham.	Northumberland, Cumberland, and Durham North of the Wear.  Durham South of the River Wear in its course from the sea at Sunderland up as far as Harraton near Chester-le-Street, and from thence westward, the line of the Pontonand Shields branch of the North Eastern Railway.			
Frank N. Wardell, Esq., Wath-on-Dearne, near Rotherham.	The West Riding of Yorkshire.			
Thomas Evans, Esq., Field Head, Belper.	Derby, Nottingham, Warwick- shire, and Leicester.			

Names of Inspectors	District under Inspection				
Thomas Wynne, Esq., Stone.  James P. Baker, Esq., Tattenhall, Wolverhampton. Joseph Dickinson, Esq., Pendleton, Manchester. Peter Higson, Esq., Brooklands, Swinton, Manchester. Lionel Brough, Esq., 11 West Mall, Clifton,	North Staffordshire, Shropshire, and Cheshire. South Staffordshire and Worcestershire. North and East Lancashire, called the Manchester District. West Lancashire, the Wigan and St. Helen's Districts, and North Wales. Monmouthshire, Gloucestershire, Somersetshire, and Devonshire.				
Bristol. Thomas E. Wales, Esq., Brunswick place, Swan- sea.	South Wales coal field.				
Ralph Moore, Esq., 7, Queen's Square, Glas- gow.	Scotland.— Eastern Division—in- cluding East Lanarkshire, Fife- shire, Clackmannanshire, Had- dingtonshire, Edinburghshire, Linlithgowshire, East Stirling- shire, &c.				
William Alexander, Esq., 23, India Street, Glasgow.	Scotland. — Western Division—including Ayr, Dumfries, Dumbarton, West Division of Stirling, and part of Lanarkshire.				

## MINERAL STATISTICS FOR THE YEAR 1871.

#### SUMMARY OF COAL PRODUCE OF THE UNITED KINGDOM FOR 1871.

						Tons.
Durham and	North	umb	erland	1.		29,190,916
Cumberland						1,423,661
Yorkshire						12,801,260
Derbyshire						5,360,000
Nottinghams	hire					2,469,400
Warwickshir	е.					723,600
Leicestershire	е.					699,900
Staffordshire	and V	Vorc	esters	hire		14,281,250
Lancashire						13,851,000
Cheshire .						975,000
Shropshire						1,350,000
Gloucestershi	re.					1,412,597
Somersetshir	е.					673,878
Monmouthsh	ire					4,915,525
South Wales						9,120,000
North Wales						2,500,000
Scotland .						15,438,291
Ireland .						165,750

Total produce of the United Kingdom . 117,352,028

We estimate the coal raised in 1872 in the United Kingdom at 121,000,000 of tons, the Iron ore raised at 19,000,000 of tons, and the quantity of pig Iron made in the United Kingdom 7,250,000 tons.

After well considering the matter, we see good reason for giving the above figures, which will turn out to be as near the mark as can be expected in a mere estimate. We have received returns, but as these are not complete, we have been obliged to fill up the hiatus according to our own judgment, which, relying on the data in our possession, has been exercised with care, after much consideration.

Scotland shows a falling off. Cleveland and most other districts exhibit an increase in the make of Iron in 1872. Coal and Ironstone have been consumed in the same increased *ratio*. The great activity over last year in all trades and manufactures consumed more coal by far than formerly.

The export demand was insatiable all the year; we therefore think that 121,000,000 tons of coal is as low as we ought to reckon the aggregate out-put for the United Kingdom.

The area of the British coal-fields is estimated at 4,250,000 acres, and no less than 64,661,000 tons of coal were raised in the United Kingdom in the year 1854, 20 years since valued then at 14,975,000l. Of this sum 47,422,000 tons were raised in England, 9,643,000 in Wales, and 7,448,000 in Scotland, and 148.000 in Ireland. The area of the coal-fields of France is about six times less than that of Great Britain, whilst their product is sixteen times less. total number of collieries in the United Kingdom in 1854 was 2,327. Of these 1,704 were situated in England, 306 in Wales, and 368 in Scotland, and 19 in Ireland. The average number of tons raised to each workman employed in the United Kingdom in 1854 was 293; in France in 1852 the average was only 136 tons to each workman engaged.

# NUMBER OF COLLIERIES IN EACH INSPECTOR'S DISTRICT.

#### ENGLAND AND WALES.

District	Name of Inspector	Number
Northumberland and Durham, north division Cumberland .	Geo. W. Southern, Newcastle-on-Tyne.	} 164
Durham, south division Yorkshire	James Willis, Old Elvet, Durham. Frank N. Wardell, Rotherham.	} 140 } 423
Derbyshire Notting hamshire . Warwickshire . Leicestershire .	Thomas Evans, Belper.	<b>187</b>
Cheshire Shropshire Staffordshire, North	Thomas Wynne, Stone.	
Staffordshire, South, and Worcestershire.	James P. Baker, Wolverhampton.	307
Lancashire, North and East, or the Man- chester district.  Lancashire, St. Helen's	Joseph Dickinson, Pendleton, Manchester.	287
and Wigan .   Flintshire   Denbighshire .   Anglesea	Peter Higson, Manchester.	  > 157 
Gloucestershire . Somersetshire and Devonshire . Monmouthshire . East of Glamorgan- shire .	Lionel Brough, Clifton, Bristol.	) } 196
Glamorganshire . Pembrokeshire . Caermarthenshire	Thomas E. Wales, Cae Bailey, Swansea.	

# NUMBER OF COLLIERIES IN EACH INSPECTOR'S DISTRICT-continued.

#### SCOTLAND.

District	Name of Inspector	Number
Lanarkshire, west division	William Alexander, Glasgow.	> 204
Lanarkshire, cast division	Ralph Moore, Glasgow.	> 216
	IRELAND.	
Ulster coal field . Connaught . Leinster coal field Munster coal field T	No inspector.	. 2,760

COAL AND COKE.

All the Countries receiving the Principal Exports in the Year 1871.

Contract to the No.	Quantities I	Exported.	Declared Value.		
Countries to which Exported.	Coal.	Coke.	Coal.	Coke.	
	Tons.	Tons.	£	£	
Russia: Northern Ports	665,360	40,099	314,168	26,412	
" Southern Ports	207,228	1,101	102,141	813	
Sweden	369,666	27,884	173,090	20,145	
Norway	221,655	7,102	95,230	5,000	
Denmark	648,191	10,510	284,119	7,495	
Germany	2,331,304	65,507	969,839	42,965	
Heligoland	116	_	40	_	
Holland	502,055	4,310	223,292	3,087	
Belgium	116,703	-50	50,443	30	
Channel Islands	74,302	568	36,294	394	
France	1.968,227	8,971	889,049	4,898	
Portugal, Azores, and Madeira	169,631	4,228	87,748	3,215	
Spain and the Canaries	475,852	78,966	257,698	56,281	
Gibraltar	131,331	33	74,584	26	
Italy	791,897	16,498	366,906	10,962	
Austrian Territories	85,016	7,104	41,740	4,865	
Malta	186,957	10	102,976	11	
Greece (including Ionian Is-	100,007	1 1	102,010		
lands)	61,704	17,351	33,942	11,294	
Turkey	277,004	1,505	146,833	1,103	
*** ** * * * * * * * * * * * * * * * * *	38,704	224	18,540	135	
			230,317	2,318	
Egypt	451,912	3,557		2,010	
Tripoli and Tunis	1,995	-,	1,038	34	
Algeria	25,219	- 58	12,368	94	
Morocco	629	_	326		
Western Coast of Africa	49,289	_	29,298	_	
Ascension	3,065	_	1,712	_	
St. Helena	150	_	150	_	
British Possessions in South					
Africa	20,792	1,642	12,130	1,357	
Eastern Coast of Africa	1,768	_	1,020		
Mauritius	13,748	62	7,346	98	
Arabia, Aden	87,394	100	47,866	100	
" Muscat	1,426	-	855	_	
Persia	602	-	602	_	
British India: Continental					
Territories	335,210	15,915	187,392	16,405	
,, Straits Settlements .	114,373	_	66,206		
, Ceylon	107,625	138	57,479	170	
Java	44,840	924	24,406	1,146	
- Other Dutch Possessions.	3,432	_	1,736	_	
Phillipine Islands	2,580	_	1,621	_	
Borneo	501		251	_	
Siam	1,302	125	1,331	167	

# 198 COUNTRIES RECEIVING THE PRINCIPAL EXPORTS.

All the Countries receiving the Principal Exports in the Year 1871 (continued).

	Quantities E	xported.	Declared Value.		
Countries to which Exported.	Coal.	Coke.	Coal.	Coke.	
	Tons.	Tons.	£	£	
Cochin China	650	-	392	-	
China and Hong Kong	90,575	137	55,192	187	
Japan	14,083	30	8,383	36	
Australia	8,711	924	6,128	1,214	
Islands in the Pacific	480		251	_	
British North America	189,274	1,406	86,318	996	
United States of America:					
On the Atlantic	91,483	-	61,524		
On the Pacific	60,365	_	31,596		
British West Indies	175,335	224	99,387	308	
Foreign West Indies	281,877	452	149,574	335	
Mexico	2,821		1,227	_	
Central America	114	30	114	47	
United States of Columbia					
(New Granada)	11,241		7,190	-	
Venezuela	370	5	204	5	
Ecuador	1,015	-	896	_	
Peru	109,393	2,137	70,410	1,605	
Bolivia	2,094	_	920		
Chili	101,203	4,146	48,734	2,928	
Brazil	316,417	12,890	188,036	9,083	
Uruguay	96,648	303	65,888	228	
States of the Argentine Con-			1		
federation	62,860	4,639	42,970	3,521	
Falkland Islands	245	_	224	_	
Total	12,208,009	341,865	5,879,680	241,419	

## CHAPTER XXIV.

SHIP-BUILDING YARDS ON THE BANKS OF THE CLYDE.

Glasgow affords great facilities for shipping the Iron made in that district, the Clyde coming up to the City and ministering to Connal's great stores in the most convenient manner. The shipbuilding yards on the banks of the Clyde are the largest and most numerous in Great Britain. Steamers of all sizes are built here for all nations; the skill of the Scotch engineers is unrivalled in England, and the names of Napier, Thomson's, and Elder & Co., are well known in connection with high class steamers in all parts of the world. The best steamers in the world are built on the Clyde. This noble river, with hundreds of building yards on both banks for miles, as you steam out of Glasgow, presents one continued succession of gigantic works, occupied principally in Iron naval architecture. Steamers are launched every month, and the great works themselves are mementoes not only of the superiority of the Clyde makers over all others, but as a proof of the grandeur of Scotch enterprise, of which England has good reason to be proud.

Mr. John Elder has done wonders in carrying out the wholesome advice so often and ably given by Sir William Armstrong, to economize fuel in the generation

of steam by perfecting the high and low pressure steam-engine, which is now accepted by the great engineers on the Clyde. These engines, at this time, are universally applied at with from sixty to eighty pounds pressure in the direct acting compound surface condensing engine, with a saving of just one half the quantity of fuel; the present firm of John Elder & Co. are still pursuing the same course of economy, with further improvements. This firm, by adopting Rowan & Orton's (of Glasgow) Patent Boiler, declare that with a pressure of 120 lbs. and three cylinders, they will reduce the consumption of fuel to a minimum of 1 lb. of coal per horse-power per hour. Steamers are built here with 3,000 horse-power each, and Messrs. Caird & Co. have engines in hand now for one vessel 5,220 horse-power. Mr. Robert Duncan, Port Glasgow, is now engaged on plans of steamers 600 feet long, probably to trade between the great Ramsden dock at Barrow and the port of New York. This noble river, with its engine-shops and yards, is a marvel in the metallurgical industries of our land; and by improved steam-engines and noble Iron steamers will, with honour, transmit to posterity the names of John Elder, Laird & Co., Robert Duncan, the Elders, Napiers, Dennys, and Sir William Thompson. Rankine is gone, and the Clyde loses his transcendant ability; but John Elder has made munificent provision for instructing suitable young men who aspire to practise the arts of building Iron ships and steam engines, and practically to apply those great principles which Rankine taught so well.

# CHAPTER XXV.

#### THE NEW TRADE OF STEEL CASTING

Has made rapid progress in this country since its first introduction at Krupp's great works; and as cranks, and all other important parts of steam engines and other machinery, can now be run out from the crucible of the best material, where tensile and tortuous strains are excessive this kind of manufacture is invariably preferred.

#### CRUCIBLE STEEL CASTINGS

Is a branch of the Sheffield steel trade of modern development, and promises to become of great magnitude. Krupp, of Prussia, was one of the first to make large castings in steel, but Krupp has long since been surpassed by Messrs. Vickers, of Sheffield, who may be considered the founders, &c., by originating and manufacturing all kinds of steel bells, and who are still the only large makers of crucible castings of steel, in large contracts, in England. To show the increasing importance of this trade, Messrs. Hadfield's Steel Foundry Company, Newhall, Sheffield, have just completed extensive premises and plant, covering a couple of acres with machinery, and improved appliances, for

the manufacture of smaller steel castings of all descriptions, and who claim to be unsurpassed. The firm devote their personal attention, and claim a special excellence in having secured sound castings in crucible steel, from 1 lb. to several tons in weight, and also a superior method of annealing their castings to any engine, their success being such as to necessitate the erection of their new works to meet their increasing trade. We are informed by practical parties that they possess one of the most complete and well-arranged foundries of the kind. It is really surprising to learn how many and varied are the uses these castings are applied to, from reaping machine fingers to screw propellers for steam ships. This seems a great step, but from hydraulic cylinders to colliery, tram, and railway wheels seems greater. Pinions, engine shafts, plough-shares, horn-blocks, and axle-boxes, will give some idea of the articles to which they are being applied. In fact, crucible steel castings are fast replacing metal work and wrought Iron forgings, their superior qualities, viz., great tenacity, strength and lightness, giving them special advantages over other metals.

We understand Mr. R. Hadfield has patented an improved double disc railway wheel, the tyre of which is steel or Iron, with a metal centre welded thereto; owing to its construction, it is a certain preventative against all railway accidents from tyres breaking. It can be manufactured cheaper than ordinary wheels. Mr. H. has also patented a capital cheap and durable method of fastening crucible steel wheels fast on the axles, so that they cannot work loose. We understand that

Messrs. Hadfield's Steel Foundry Company recently received from one firm alone an order for fourteen hydraulic steel cylinders, weighing upwards of one ton each. This will give some idea of their capabilities.

# CHAPTER XXVI.

#### WILLENHALL AND ITS LOCKS AND BOLTS.

WILLENHALL, the real seat of the lock, door-bolt, and latch manufacturers for the world, is a township in the parish of Wolverhampton, and is connected with it by two lines of railways, viz. the old Grand Junction line, and one recently opened, the Wolverhampton and Wallsall line. Willenhall being just three miles from either town, now contains about 20,000 inhabitants, a complete hive of industry. We believe there are some five to six hundred separate manufactories (of course some only small concerns) of rim, mortice, drawback, dead, cupboard, drawer, box, and pad locks; all kinds of latches and door bolts; currycombs, gridirons, box-iron stands, and skewers; horse scrapers and singers; carpet-bag frames and locks; box corners and clips; keys of all descriptions; and stampers of an endless variety of articles for the gun, steel, toy, and other trades carried on in neighbouring towns. are also Ironfounders, brassfounders, and wrought Iron works, blast furnaces and collieries in abundance. these mainly must be attributed the rapid growth of this industrious town. The writer can well remember when three to four thousand was the extent of its population. In those happy old days of the past there

was one church, with a blaspheming drunken parson, who spent six times more of his time in the publichouse than in the church, the only one the place possessed. In those times there was no Methodist or Dissenting resident minister; and what is more, no magistrate, no lawyer, no police, and not an inhabitant (except the parson) but what was engaged in some kind of business. At the present time the township of Willenhall contains four churches, five Wesleyan chapels, four Baptist chapels, five Methodist chapels of various denominations, and one Roman Catholic chapel, which represents one place of worship for every thousand of the population, a fact few towns can boast of; with good school accommodation, British, National, and Wesleyan, and a literary institute of no mean pretensions, having its reading, recreation, and class rooms, a good lecture hall, and a well-furnished library.

On visiting some of the manufactories of Willenhall, we found the Albion works one of the most prominent, employing some hundreds of work-people. The business carried on here was established in the last century by the father of one of the present proprietors; and one of the principal branches of the trade, that of door bolts, was extensively carried on by the grandfather of the other more than eighty years ago. At these works we find manufactured rim, dead, and mortice locks; spring, rim, night, Norfolk, Suffolk, and Lancashire thumb-latches, in various ornamental designs; door-bolts in prodigious quantities. When in full employ they can produce 120 gross per week of

this one article, aided by steam stamps, Nasmith's steam hammer, and steam presses for forming the various parts of the bolt, and piercing the holes in the plates; also pulleys for every conceivable purpose; sash, signal, and sliding doors; hat and coat hooks; door buttons, and black ironfoundery generally. also find a large quantity of door-lock knobs, sold principally for export, called 'Harper & Co.'s patent mineral lock furniture.' At the time we write, they are engaged on orders for nearly 100,000 brackets, made of malleable cast Iron—these are for various telegraph lines, both for home and abroad. In this branch the Messrs. Harper & Co. excel. Our pen would fail to write the variety of purposes to which the malleable castings are now applied; suffice it to say, their patterns consist of more than three thousand different kinds and sizes.

The largest lock manufactory here, and perhaps one of the oldest, is Carpenter & Tildesley's, well-known in England and all the Colonies for their locks of various kinds, particularly 'rim' locks. They are the largest lock and curry-comb makers in Willenhall, and employ the greatest number of hands in lock and key making of any house in Willenhall, having especial machinery for this purpose. This firm stamp their own keys. Mr. James Tildesley is son-in-law to the late Mr. Carpenter, and is the proprietor of these ingenious works. This is a highly respectable firm, and capable of executing orders to any extent of all kinds of locks.

### CHAPTER XXVII.

THOMAS PERRY AND SONS GREAT ENGINE WORKS AND FOUNDRYS AT HIGH FIELDS, BILSTON.

We know of no concern which has done more to raise the character for engineering skill in the Black Country than Thomas Perry & Sons. This is a highly respectable old firm engaged in metallurgical pursuits. 50 years since—the firm then was Thomas Perry—the family resided at Bilston, and as there were at that time numerous Perrys in business, Mr. Perry, to distinguish him, was always called 'Gentleman Perry,' and was highly esteemed and loved by all classes. Mr. Perry, with Mr. Sparrow, was one of the founders of the Bilston District Bank, and remained a director until his death.

He was quiet, unostentatious, always a gentleman, was never known to forget himself or become agitated in business; he was amiable and polite to all; a great friend to his church and the clergy; a man of spotless and the highest reputation. In the social circle at home for goodness he was unequalled in all Staffordshire; so amiable, so gentle, truly polite and kind was Mr. Perry in his own family to each member to the day of his death, although he lived to an advanced age. Mr. Charles T., the eldest son, married

Harriet, the third daughter of the late G. B. Thorney-croft, Esq., the first mayor of Wolverhampton and the founder of the firm of G. B. Thorneycroft & Co. Mr. Thomas Perry, the second son, is now at the head of the concern under review.

This foundry has a world-wide fame, and has done more in supplying new machinery and appliances, abreast with the rapid progress the Iron trade has made during the last ten years, than many other establishments.

Steam engines and all kinds of machinery are their great specialities, with all modern inventions in rolls and machinery in Ironworks. At this foundry the choicest brands of pig Iron are kept in large quantities, including Lilleshall, Madeley Wood, Blaenavon, Weardale, and different Swedish brands, mixed in proportions known only to Perry & Sons, to make soft and chilled rolls, for rolling plates, sheets, armour plates, &c., &c.; for the manufacture of which this firm is justly celebrated.

Here some of the rolls used at the Earl of Dudley's, W. Barrows & Sons, the Barrow Steel Company, Robert Heath & Sons, the Blochairn in Scotland, and most other great concerns, are made.

We know of no concern which has done more to raise the character for engineering skill in the Black Country than Thomas Ping & Sons. This firm often take contracts for complete Iron works for foreign countries. They have a good name for blast engines; all the blast engines at the Steel Company's works at Barrow were built by this firm—safes of a very high

class are made here, and other specialities out of the range of the fitting business.

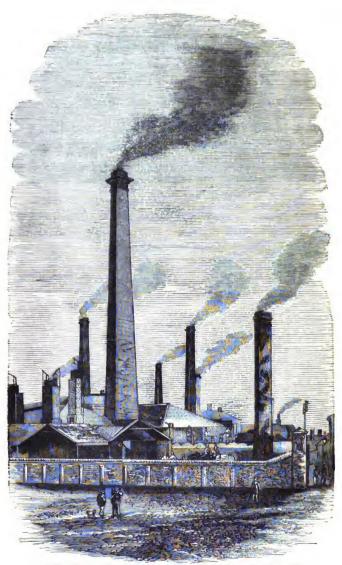
## THE ALBION IRON WORKS, WEST BROMWICH,

Represented by the annexed engraving, were erected at great cost thirty years since, in the most substantial manner, by the late Walter Williams, Esq.

The plan, general arrangements, and architecture of the Albion Works reflect credit on the judgment of the late Mr. Walter Williams, who took pride in the works, and always sent a quality of Iron into the market from these works which established their first-class brand throughout the country. The late proprietor was the eldest son of the first Mr. Philip Williams, of Wednesbury Oak, the founder of the well-known 'Mitre' brand of Iron.

These extensive works are now carried on by several firms. The Albion Sheet Iron Company and the Britannia Iron Company (the proprietary being almost identical) have here two forges, consisting of nineteen puddling furnaces, two sheet mills, and a bar mill, where are made sheets of very superior quality of the well-known 'Trident' brand, and bars—small rounds and squares—with various kinds of fancy Iron, marked 'Britannia Iron Co.

Their sheets, bars, and specialities in Iron, take a high position in the market. The firms consist of Titus Greenway, William Dangerfield, Henry Lewis, Edward W. Lewis (the Albion Sheet Iron Company), and of Henry Lewis, Edward Lewis, and William P.



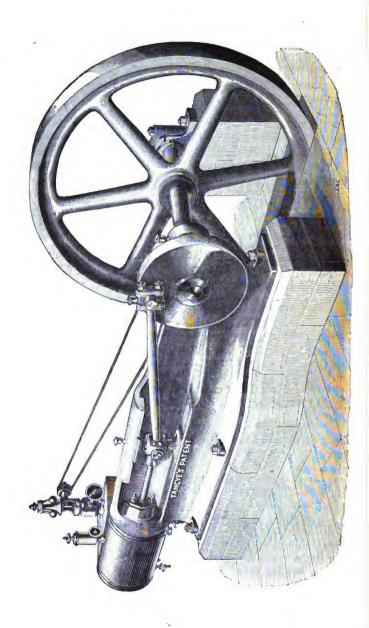
BRITANNIA IRON COM ALBION WORKS, WEST BROMWICH.

Greenway (the Britannia Iron Company). For many years Mr. Titus Greenway held the responsible position of sheet-mill manager to the late Mr. Samuel Mills, of Darlaston Green. Mr. Dangerfield was, for over a quarter of a century, mill manager to Messrs. G. & E. Walker, of the Gospel Oak Iron Works, makers of the celebrated GO & sheet Iron.

The Messrs. Lewis were instructed in Iron making at Wednesbury Oak, under Messrs. Philip Williams & Sons, where the famous 'Mitre' brand of Iron is made; and Mr. W. P. Greenway has had considerable experience under our own relative, the late worthy Samuel Mills, of the well-known Bills and Mills firm of Darlaston Green. Every member of these firms is therefore a practical Iron maker.

# TANGYE BROTHERS AND HOLMAN'S DIRECT-ACTING STEAM PUMPING ENGINE.

THESE engines have created a great revolution in the machinery now in use for hydraulic purposes in mines. A hundred years since water in coal, Iron, and all metalliferous mines, was the great enemy alike of the mineral lord and the sturdy adventurer; hence thousands of mines were abandoned the moment the lode or coal measure dipped into the water-pond, and hundreds of thousand pounds' worth of subterranean treasure from this cause was left by the old men in the earth unutilised. Hence it often occurs in mining counties that an old pit-shaft is discovered by accident on a farm now devoted to agriculture, where every

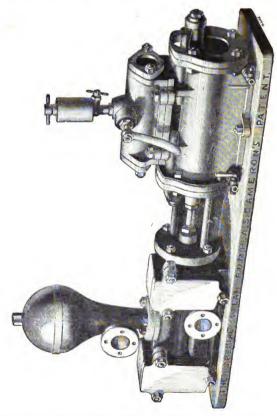


vestige of pits or mining appliances are removed by the hand of time and agricultural operations. Tempus edax omnium rerum. About the year 1782, the Carron Company in Scotland erected a water-engine which, for its dimensions and capabilities, was looked upon as one of the wonders of Scotland. Sir J. Sinclair, who wrote in 1792, speaking of this engine, says:—

'These works consisted of five blast furnaces, and made their own fire-bricks, had a Water Engine, that worked seven strokes a minute, raised 3,500 gallons of water at one stroke. The same engine consumed 16 tons of coal in 24 hours.'

At a more recent date more powerful machinery was invented, and our friends in Cornwall took the lead in this respect, and constructed steam-engines on what is called the 'Cornish plan,' which have since been in vogue at all our metalliferous mines. The cost of these engines, however, is a bar to their adoption. The foundations, house, and other appliances frequently costs ten, fifteen, and even twenty thousand pounds, much in this respect depending on the depth of the mine to be drained. These remarks must not be taken as inveighing against the Cornish engine. the contrary, we say they do more service with a smaller amount of fuel by far than any of their predecessors, but the cost of foundations, the complicated machinery, the beam, the massive centre gudgeon, the valves, the levers, the hand gears, the air-pump and condenser: in fact, the whole machine, for the service it renders, cannot be compared with the unique and

scientific apparatus in the engraving annexed, invented by Mr. A. S. Cameron, of New York. Already 3,500 of these engines are fixed and at work, all made at



the great Cornwall works of Tangye, Bros., at Soho and Birmingham.

It will be observed by the engraving that there is

nothing to be seen moving but the piston rod in its constant reciprocations, the steam cylinder to the right and the pump to the left. The power exerted by the steam on the piston is expended in the pumps through the medium of the piston rod itself, the reversing valves are operated by the piston, all is closed up, nothing exposed to view, and the speed of the engine is retarded or accelerated ad libitum by the regulation of a simple supply valve.

The great advantage of these pumps is the facility with which they can be laid down; like the horizontal engine they are fixed with very little cost, they rarely get out of order, the seats of the valves being made of vulcanized india-rubber or something of this kind. A gentle sounding click is heard, which has no ring of metal, but rather gives the idea that everything is tight and sound like the air pump bucket of a condensing engine when it has been recently packed with a good white rope. These engines are now, we understand, fixed in the nethermost depths of the mine, and lift the water to the top; this plan answers well, preventing the strain and continual disturbance of the water trees where the old engines are used. The steam may be generated in the pit or at grass at pleasure; of course, if the latter, steam pipes are fixed to descend the shafts to the engine. They can be fixed of any size required by the work to be done, and the small cost when compared with the old engines is marvellous and astounding, and no doubt they are rapidly coming into universal use in all parts of the world. The works of this great firm are situated very near to

the old Soho Works, near Birmingham. They have likewise another large factory in Birmingham. In looking over the Soho Works the other day, we were pleased more than we can express. They are of immense size, and employ twelve hundred men; and the wholesale way in which the work is got through is marvellous. We should think there were fifty or sixty of these engines of different sizes in course of erection. We frequently saw two or three cylinders being bored by the same machine at the same time. The slotting, drilling, boring, punching, turning, planing, forming, and forging machines, with all the men actively at work, was gratifying to witness. Here hydraulic power is used for cutting, punching, forging, &c.

The foundries and casting shops in brass and Iron, the smithies and chain-making shops, are all abreast, if not in advance, of the day in which we live. The offices, and even the warehouses for exporting the produce of this wonderful hive of industry, were admirable in the highest degree. There is likewise here a spacious dining-hall for the men, with stoves and cooking apparatus under proper management, where the artizans may have tea and coffee for breakfast and their chop or steak cooked for dinner, and no doubt, although we did not enquire and cannot speak positively, a library is kept and a sick club under the management of the able gentlemen who established, and with such spirit and regularity carry on, this great concern of Tangye, Bros. At these works, besides the Special direct-acting Steam Pumping Engines referred

to above, are made Hydraulic and Screw Lifting Jacks, Cranes, Differential and ordinary Pulley Blocks, and a very large number of their newly designed Horizontal High Pressure Steam Engines. Also Ramps for speedily re-railing Railway Carriages in the event of their getting off the line. Hydraulic and Screw Presses for every variety of purpose. Hydraulic Testing Machines, Morton's Patent Self-sealing Retort Lids with Holman's Patent Fastenings, Holman's Patent Purifier Lifts and Double-acting Pumps, Oesterkamp's Patent Rock Borer, and a great variety of special articles.

The Messrs. Tangye, Brothers, we believe, have a Depôt at Newcastle. The London business offices are at 10, Laurence Pountney Lane, E.C., under the direction of Mr. Holman, the managing partner in London.

### PARTICULARS OF MANUFACTURERS AND THEIR QUALITIES.

- N. Hingley and Sons: furnaces, 4, 3 in blast; puddling furnaces, 42. Make best cable iron. Old Hill and Nertherton furnaces, Brand: N.H. & S. .
- Pontnewynyod Iron Works, Pontypool: pudd. furnaces, 26, and building more. Make wire rods, tin bars, and sheet iron. Iron quite first class. No B. furnaces.
- Wilden Iron Works, near Stourport: proprietors, J. P. and W. Baldwin; one of the oldest works in Worcester: sheet iron and tin plates, both of the very best quality. Charcoal, sheet iron, and tin plates. Brands: all sheet iron branded 'BALDWIN-WILDEN,' and marked with distinguishing quality, 'B,' 'B B,' 'B B,' 'B. CHAR'L,' 'E.B. CHAR'L.' Tin-plates for deep-stamping—branded 'E.P. × W.B., BEST CHAR-COAL TIN.' Tin-plates for general working—branded 'WILDEN-CHARCOAL,' 'UNICORN-CHARCOAL TIN,' 'ARLEY & TIN.' Coke tin-plates—branded 'STOUR
  - 'ARLEY & TIN.' Coke tin-plates branded 'STOUR COKE TIN.' Tin-plates specially prepared for gas-meter purposes. Our sheet iron is not only marked 'B,' 'B B,' &c., but the brand 'BALDWIN-WILDEN' is on the bands of each bundle.
- Withymoor Furnaces: 2 in B. Make best hydrate iron.
  W. Dawes and Sons, proprietors.
- Henry Hall, Old Level Works, Brierley Hill: 18 puddling furnaces. This iron is very good. Best and best best bars—rounds,  $\frac{3}{16}$  in. to 4 in. diameter; squares,  $\frac{1}{4}$  in. to  $3\frac{1}{2}$  in. square; flats,  $\frac{1}{2}$  in. to 6 in. wide; hoops and slit rods; colliery rails; T angle and fancy iron. Brand \$\psi\$ LEVEL \$\psi\$, HALL'S B B \$\psi\$.
- The Darlaston Steel and Iron Company, established 1799: 42 puddling furnaces, 3 B. F., all in B. Brand. The undermentioned Brands are the Trade Marks and Brands of the Company, and are stamped upon iron and steel at their Works, and are used to distinguish the various qualities of iron and steel made at the Works, all the very best:—



No. 1. 'CHAMPION.' No. 2. 'L & DAR-LASTON.' No. 3. 'SAMUEL MILLS.' No. 4. 'G. F. & G. F.' No. 5. 'LLOYD'S DARLASTON.' No. 6. 'LLOYD'S CHARCOAL.' No. 7. 'L & STEEL.'

No. 8. 'STEEL.'

CHAMPION. Gold, Brothers, Sudely Furnaces, Forest of Dean: 2 B. F., 1 in B.

The Ashton Vale Iron Company, Bristol. Very good iron. 1 B. F., 1 in B.

Gjers, Mills, and Company, Ayresome Iron Works, Middlesborough: 4 B. F., 4 in B.

Appleby and Company, Renshaw Iron Works, Chesterfield:
4 B. F., 3 in B. Established 1785. Large iron founders.

The Chillington Iron Company: 95 P. F., 6 B. F. Brand, CC, LB & Chillington.

Tredegar Iron Company: 80 P. F., 9 B. F., 7 in B. Rails and Fish Plates. Brand T. I. CO.

Fletcher, Solly, and Company, Willenhall: 3 B. F., 3 in B. Very good iron.

Lloyds and Company, Middlesborough: 6 B. F., 6 in B. Brand, 'Linthorpe.'

Bilston Brook Furnaces: 3. B. F., 2 in B. Cinder foundry and forge iron.

M. S. Goddard and Sons, Lane End Iron Works: 2 B. F., 2 in B. About to erect 1 new furnace.

Messrs. Round: 2 B. F., 2 in B. Best mine iron.

Roberts and Company, Tipton Green Furnaces: 4 B. F., 4 in B. Good melting iron for making bedsteads and forge iron.

Watson, Kepling, and Company, Seaham: 1 B. F., 1 in B. Erecting one new furnace, 1871. Make first-class Bessemer iron.

North of England Iron and Coal Company (Limited), Carlton Works, Stockton-on-Tees: 3 B. F., 3 in B. 8 patent Danks's puddling furnaces.

Thomas Webb and Sons, Bretwell Hall and Bretwell Lane Iron Works, Stourbridge: 21 puddling furnaces. Hoops, rods, and angle iron. Brand.

Sevann, Coates, and Co.: 4 B. F., all in blast. Brand, Cargo Fleet.

The Wingerworth Iron Company, near Chesterfield: 3 B. F. all in B.

Lumphinnans: 2 B. F., 1 in B.

Frodington Works: 4 B. F., 4 in B., 1864.

The Weardale Iron Company, Towlaw Iron Works: 4 B. F., 2 in B. 1 undergoing repair. This is very superior iron, quite the best made in this district. No. 3 Pig being worth 8l. per ton to-day.

Messrs. Molineux, Bull's Bridge Iron Works, Morley. Make best thin sheets. Brand, a bull's head.



Messrs. Fowler and Company, Barbor's Field Iron Works, Bilston: 2 B. F., 1 in B. Very best forge mine iron.

Mr. John Marshall, Monway Iron Works, Wednesbury: 10 P. F. Bars, sheets, all best and best best charcoal, and extra best charcoal for the government. Price to-day, from 331. 10s. per ton to 5d. per lb. Mr. Henry Mills, of the Pleck Iron Works makes the same qualities and gets the same price.

Hugh Martin and Sons, Coatbridge Iron Works: 7 P. F. First class rivet iron.

Brymbo Iron Company, Wrexham: 2 B. F., 2 in B. 1 new one building; established 1797.

Lee and Bolton, Hyde Iron Works, Stourbridge: 20 P. F. 2
Siemens' furnaces at work here; brand of iron first class. These
are works that first rolled slit rods, which were introduced
by the ingenious Foley, who obtained admission into the Russian Iron Works by the charming strains of his violin. See
account of his journey in the Guide. Brand, 
□ L & B. This
is perhaps the oldest works in Worcestershire, always makes
first class iron, and has the Honourable Foley's first made rods
here. Lee and Bolton continue this trade. The works are
situated in a lovely spot and charming country. See Engraving.
They likewise make plating, bars, wire rods, best bars, and
best sheets, and obtain the highest price.

Norton Iron Company (Limited): 5 B. F., 4 in B. 1 of these working on Norwegian Titanic ore making Bessemer iron, and for this 8l. 5s. per ton is now obtained.

- Robert Crawshay, Cyfartha Iron Works, Merthyr Tydvil, one of the oldest works in England, established 100 years: 11 B. F. All on strike. Brand, W.C. Make bars and rails at the works. 72 P. F.
- W. Barrows and Sons, Bloomfield Factory, and Tipton Works:
  100 P. F. Makes 60,000 tons a year of the very best Staffordshire iron. First quality, has a world-wide fame. Brand,
  Brand,
  generally fetches 1l. per ton more than all other
  Staffordshire makes, SC2 and the Earl of Dudley's excepted.
- Mr. John Spencer, Phoenix Iron Works, Coatbridge, Scotland: 22 P. F. Bars, angles, and boiler-plates, high class quality. Brand, Phoenix.
- Snedshill Iron Company, Snedshill, Salop: make bars, plates, sheets, and wire rods. Quality of all the iron made here is first class, being entirely made from Earl Granville's best Lilleshall
  - pigs. Brand, H. S  $\Leftrightarrow$  BEST Mr. Thomas Horton, Prior's
  - Lee Hall, and his brother, Mr. Samuel Horton, are partners in this concern. They deservedly stand very high in the market for all kinds of iron they make, and have a number of charcoal fires, and produce charcoal wire rods in perfection.
- Britannia Iron Company, at the Albion Works, West Bromwich, has 10 puddling furnaces, where bars, small angles, rounds, squares, half rounds, and all kinds of fancy iron are made. The quality is of the highest class. The brand, BRITANNIA IRON CO. . The iron made here fetches high prices.
- Albion Sheet Iron Company, West Bromwich, have 10 puddling furnaces, and 2 sheet mills and a bar mill, where the famous 'Trident' sheets are made which fetch such high prices. This and the firm above are noted practical men in iron making.
- George Adams and Son, of the 'Mars' Priestfields Iron Works, Wolverhampton, have 12 P. F. and 3 mills. Make bars, sheets, and hoops of the very highest class. Mr. George Adams being a very able and experienced manager in this capacity, he contributed by his able management to the fame of the brand of Rose, Higgins, and Rose's iron, of Bradley Field, and Wright and North's, of Wolverhampton, to whom he was chief manager for years. His own brand of iron now stands quite as high as either; a plate of these works will be found in the Guide. Brand, 'Mars.' All best iron made here, best, double best, &c., &c.

William Millington and Company purchase all their pigs, have no blast furnaces. They have 20 puddling furnaces, and 4 mills and forges, situated at Summer Hill, Tipton, railway station near to the works. These works have been established upwards of 40 years, and stand well in the market for the quality of their boiler plates. Brand, W M Co. surmounted by a dove, or S H Crown. Besides boiler plates, they make angles, plating bars, rivet iron, half rounds, ovals, small rounds, and squares. All their qualities of iron are good, and may be shipped with confidence. Their make of finished iron is 7,000 tons per annum. Their price to-day is 15l. 10s. for bars, and 19l. 10s. for plates. In the Paris Exhibition their iron was 'honourably mentioned.'

The District Iron and Steel Company is situated at Smethwick, 300 yards from the Stour Valley railway station. Are very good works, capable of rolling most kinds of iron, were built 50 years ago, have 4 mills, 3 forges, and 20 puddling furnaces. The proprietors of this extensive concern have likewise other works at Church Lane, Tipton, with 10 puddling furnaces and 2 mills. There are few works in the Black Country laid down so well. At the District, the arrangements are good, near to railway, and hangs over the canal like Capri in the Bay of Naples. The engines are all up to their work, and sheet iron, hoops, bars, angles, small rounds, and squares are made here, and at Church Lane, of very good quality. Indeed, we have known these works 40 years, and they have always had the character for making good iron. The proprietors are Messrs. Broughton, Keen, and Hawkins, well known in the trade for a long period.

The Thornaby Works are situated at Stockton, carried on by Messrs. William and Thomas Whitwell. Have been in business 11 years. There are 34 puddling furnaces and 3 mills. They manufacture rounds, squares, flats, half rounds, convex angles, Tees rails, channel, and cable iron, and turn out 13,000 tons of finished iron per annum. They have 3 blast furnaces, all in blast, and make 48,000 of pig iron per annum. Now engaged in erecting 2 new ones. Brand, a Mallard Lion, W W & Co., Cleveland. Pig iron brand, THORNABY. Character of iron, good.

The following is a List of all the London Iron Merchants and Exporters of Iron, coals, and all kinds of hardwares, describing the particular Ports to which they trade; likewise Merchants and Exporters of copper, tin, lead, spelter, bullion, &c. (See our remarks at the end of the List.)

#### W. Warehousemen and Shippers. M. Manufacturers and Shippers.

Warehousemen and Skippers.	Ports.	Manufactures.
Abrahams, Hyam, A., 87, Houndsditch	Various	Birmingham and Shef- field goods
M. Adam's Patent Small Arms Co., 391, Strand		Revolvers and fire-arms
Adamson & Ronaldson, 1, Leadenhall Street	Colonies, Natal, Australia, Cape, China, and East and West Indies	Metals, files, saddlery, hardware, gunpowder, woolpack, and general
Adutt, Finzi & Co., 24, Mark Lane	Levantine Ports, Baltic, and United States	Colonial produce, drugs, metals, fruits, Man- chester goods, ma- chinery, &c.
Agricultural and General Machinery Agency (Lim.), (Wm. Smith, manager), 19, Salisbury Street, Strand	Various ,	Machinery
Aldridge, Joseph, F., & Co., 4, East India Avenue	India and China	Apothecaries' wares, ap- parel, beer, ales, hard- ware, cottons, earthen- ware, and machinery
Alexander, Fletcher & Co., 10, King's Arms Yard	Calcutta, Madras, Bom- bay, and China	Linens, machinery, hard- ware, and general
M. Alfred & Son, 54, Moorgate Street	India, Australia, &c	Fishing-tackle, &c.
Allen & King, 7, Dow- gate Hill	Continent and various	Iron and machinery
Allen Brothers & Co., Albion Place, London Wall	East Indies	Drapery, hardware, ma- chinery, cottons, per- fumery, jewellery, &c.
Allport, Douglas, 9, Fenchurch Buildings	West Indies and Natal	Cottons, linens, woollens, hardware, and general
M. Allwood & Sons, 11, London Wall	Various	Needles
W. Almond, W. J., 174, Aldersgate Street	Various	Shoe threads, nails, elas- tics, needles, &c.

Warehousemen and Shippers.	Ports.	Manufactures.
Alpe, J. P., & Co., 149, Fenchurch Street	East and West Indies, and others	Manchester goods, iron, hardware, medicines, apparel, machinery, und general
Abrutz, R., 96 & 97, Ethelburga House	Various	Iron
Anderson, T., 27, Lead- enhall Street Angier, S. H., Moore & Co., 72, Corphill	Melbourne and Auck- land Riga and Russian Ports	Timber, provisions, hard- ware, &c. Woollens, cottons, and earthenware
Ashby, Morris, 17, Laurence Pountney Lane	Various	Zinc, oxide, and sheet
Appleyard, C. H., & Co., 10, Camomile Street	Various	Hardware
M. Arnold & Sons, 35 & 36, West Smith- field	All over the world .	Surgical and retinary in- struments, cutlery, &c.
Aria & Co., 70 & 71, Bishopsgate Street Within	Jamacia, Honduras, and Calcutta	Manchester goods, hard- ware, &c.
Ashford & Brookes, 29, Great St. Helen's	Sydney, Adelaide, and Melbourne	Hardware, earthenware, glass, and general
Ashton & Co., Hatton Court, Threadneedle Street	East and West Indies, China, &c.	Manchester goods, hard- ware, electro-plate, cutlery, iron, machi- nery, beer, spirits, wine, and general
Assam Company, The (H. W. Wimshurstf, secretary), 2, East India Avenue	Calcutta	Metals, tools, provisions, blankets, &c.
Atkins, Charles, & Co., 1, Water Lane	Continent	Manchester and York- shire goods, machi- nery, and general
Austin Brothers, 81, Gracechurch Street Ayling, W.W., & Co., 24,	Cape Town and Cape of Good Hope Australia, New Zea-	Coals, metals, hardware, &c. (Ship brokers) Apothecaries' wares,
New City Chambers, Bishopsgate Street	land, East and West Indies, Brazil, and Continent	drapery, haberdashery, machinery, &c.
Azzoni, Francesco, 25, Old Broad Street	Continent and America	Iron and manufactured
Bailey, Pegg & Co., 81, Bankside, s.E.	East Indies, China, Japan, and various	Iron, metals, arms, &c.
M. Bailey, Wm., & Son, 2 & 3, Abchurch Yard	East India, China, Australia, South America, &c.	Chemicals and articles for telegraphy
Bailey, W., & Sons, 71, Gracechurch Street	Cape, West Indies, South America, and Brazils	Ironmongery and implements
Bain, Stead & Elford, Golden Heart Wharf, Dowgate	East Indies	Metals and general

Warehousemen and Shippers.	Ports.	Manufactures.
Baker & Oliphant, Wal- brook	East Indies	Surgical instruments and general
W. Baker, R., & Co., 309, Oxford Street	Australia, &c	Agricultural implements and mangles
Balleras & Liggins, 11, Leadenhall Street	Spain and various .	Iron, coals, railway plant, and general
Banks, Wm., 32, Lom- bard Street	Spain and Continent .	Coal, iron, machinery, and rails
Barber, James, Son & Co., 136, Leadenhall Street	Cape, East Indies, and Australia	Hardware, colours me- tals, leather, tools, soft goods, and general merchandise
W. Barnes, Fred., & Co., 109, Fenchurch Street; Birmingham and Sheffield	Australia, East Indies, Coast of Africa, South America, Brazils, &c.	Hardware, arms, ammunition, tools, general ironmongery, &c.
M. Barrows & Stewart, 97, Cannon Street	Australia and New Zea- land	Steam engines and mor- tar mills
Barter, W., & Co., 38, Gracechurch Street, and Lloyd's	Mediterranean, &c	Coals
Bartrum, Pretyman & Mumford, 168, Upper Thames Street	Australia, Cape, &c	Iron and copper
Basden, Townshend & Co., 11, Great St.	Russia	Machinery and iron
Helen's, and Lloyd's Bateman, W., & Sons, 10, Clement's Lane; and Baltic	Tasmania and New Zealand	Apparel, haberdashery, hardware, drapery, &c.
Bayley, J. A., 17, Grace- church Street	Italy and West Indies	Hardware, &c.
Belaieff, A. P., 10, East India Chambers	Russia and North of Europe	Colonial produce and machinery
Bell, Brandenburg & Co., 2, Billiter Square	East Indies	Cottons, hardware, ma- chinery, &c.
M. Bellamy & Smith, 5, Abchurch Yard; also Sheffield	Australia, Spain, and Germany	Hardware, files, &c.
Benohr, Henry, & Co., Finsbury Place	Italy	Manchester goods, hard- ware, &c.
Berger, Leo, 3, Philpot Lane	Trieste, &c.	Metals
Beriro & Co., 5, Idol Lane	Spain, Portugal, and Morocco	Toys, cottons, linens, iron, colonial produce, &c.
M. Bessemer Brothers, East Greenwich	Various	Iron and steel manu- factured goods
M. Binks Brothers, Staf- ford Street, Millwall	South America, Australia, &c.	Galvanized iron and zinc
Bird, W., & Co., 2, Lau- rence Pountney Hill	Continent, British, Colonies, and America	Iron, machinery, metals, and contractor's plants
Birdseye, H., & Co., 5, St. Benet's Place, Gracechurch Street	East Indies, China, Cape, and New Zea- land	Straw, hats, caps, wines, mineral waters, Man- chester goods, hard- ware, &c.

Warehousemen and Shippers.	Ports.	Manufactures.
Bischoffshiem & Gold- schmidt, Founders	Various	Bullion
Court, Lothbury M. Bishop, E., & Co., 6, Walbrook; and Birmingham	Spain, Australia, &c	Hardware
Blackwood, Conor & Co., 27, Mineing Lane	East and West Indies, Australia, and Mexico	Cottons, linens, glass, hardware, earthen- ware, coals, bricks, sundries
Blair, J. F., 21, Abing- don Street, West- minster	Various	Machinery
Blakemore, V. & R., 46, Leadenhall Street; and Birmingham	Various	Hardware and arms
Blannd, John, 123, Feu- church Street	Gibraltar	Coal
Blandy, Charles R., 25, Crutchedfriars	Madeira	Coals and general
M. Blews, Wm., & Sons, 38, West Smithfield; and Birmingham	Mexico, Spain, &c	Church bells and brass founders
Blundell, T., & Co., 52, Gracechurch Street	India, &c	Brass and copper
Blyth, Greene & Co., 3, King William Street, E.C.	Mauritius and West Indies	Iron, coal, and British manufactured goods. (Shipowners)
Boddington & Co., 9, St. Helen's Place Bolitho, T. & W., 39, Lombard Street	West Indies, Brazils, and South America Continent and all parts	Cottons, linens, hardware, provisions, glass, &c. Tin
Bordiu, Fabris & Co., 44. Coleman Street	Continent	Bullion and general
Born & Co., 13, Berner's, Oxford Street	Hamburg, Stettin, and Rotterdam	Hardware, colonial pro- duce, carpets, bricks, drain pipes, and agri- cultural implements
Borneo Company (Lim.) (J. Harvey and W. Martin, managers), 7, Mincing Lane	East Indies and China	Manchester goods, me- tals, machinery, and general
Boucher, Guy & Co.,128, Leadenhall Street	East Indies, &c	Porcelain, glass, and earthenware
Boustead, E., 5, New- man's Court, Cornhill	Singapore and Penang.	Cotton goods, hardware, earthenware, and gene- ral merchandise
Bovet, F. & A., 150, Leadenhall Street	China	Jewellery, cottons, wool- lens, and metals
Bowring, Arundel, & Co., 12, Fenchurch Street	East Indies and China	Hardware, machinery, apparel, beer, ale, cot- tons, earthenware
M. Braby, Fred., & Co. (Lim.), 17, Grace- church Street	Various	Galvanized corrugated iron and zinc

Warehousemen and Shippers.	Ports.	Manufactures.
M. Bradford, Thomas, & Co., 63, Fleet Street;	Various	Washing, wringing, and mangling machines
also Manchester Bradshaw, Henry, 129, Lower Thames Street	France, Continent, and Mediterranean	Coals and iron
Brand, Jas., 109, Fen- church Street	West Indies and United States	Cottons, woollens, glass- ware, hardware, linens, machinery, tinplate, furs, skins
Brandon, Jonathan (agent for F. M. Brandon), 12, Fen- church Street	Rio de Janeiro	Cottons, linens, iron, ma- chinery, fancy dress goods, and every de- scription of small ware
Bravo, Joseph, & Co., 3 & 4, Great Win- chester Street Build- ings	West Indies	Cotton goods, provisions, arms, ammunition, and general
W. Breillat, Joseph, 27, Blackman Street	India and Colonies .	Glass, china, earthen- ware, &c.
British Honduras Com- pany (Lim.), 2, Great St. Helen's	Belize and British Hon- duras	Cottons, linens, hard- ware, metals, machi- nery, woollens, paints, oils, &c.
M. Brook, Henry, & Co., 10, Feather- stone's Buildings	Amsterdam, India, and China	Garden engines and In- dia-rubber goods of every description
W. Brooke, R. J., 9, Houndsditch	Various	Hardware
Brookes, Robinson, & Co., 73 & 74, Ethel- burga House; 171, Bishopsgate Street Within	Colonies	Window-glass, hardware, &c.
M. Brown Brothers, 165, Piccadilly	India, China, and	Portable iron furniture,
M. Brown & Green, 72, Bishopsgate Street Within	Australia, India, and Cape of Good Hope	Kitchen ranges, portable cooking stoves, veloci- pedes, &c.
Brown & Mainnett, 26, New City Chambers	Spain and West coast of Africa	Iron, arms, and general hardware
M. Brown, Sir John, & Co. (Lim.), 10, John Street, Adelphi; also Sheffield	Various	Iron and steel manufac- tured goods
M. Brown, Lenox & Co., 8, Billiter Square	East Indies, Colonies, United States, China, &c.	Anchors, cables, patent moorings, and ma- chinery
Brown, Walter H., & Co., 11, Billiter Square	Various	Coals, tar products, pitch, creosote, naptha, petro- leum, chemicals, dry- salteries, and colonial produce
M. Brown, Westhead, Moore & Co., Holborn Viaduct	Various	Earthenware and china

Warehousemen and Shippers.	Ports.	Manufactures.
Bruce, G. G., 60, Gracechurch Street	West coast of Africa, Canaries, Madeira, St. Michael's, Tene- riffe, Mediterranean,	Cottons, provisions, arms, ammunition, and gene- ral
Bryan Brothers, 36, Crutchedfriars	South of Europe, &c. Colonies, Mediterra- nean, and various	Cottons, linens, machi- nery, and colonial pro- duce
Bryant, George, Lime Street Chambers Budd, E. L., & Co., 8,	Australia, New Zealand, East Indies, &c. East Indies, China,	Iron, tin plates, metals, and general Metals and general
Moorgate Street Budden, Jennings & Co., 48, Fenchurch Street	Continent, &c. East Indies, China, Australia, Cape, and other	Metals, Manchester, Bir- mingham, Sheffield goods, machinery, &c.
W. Burgess & Key, Holborn Viaduct	Colonies and India .	Reaping and mowing machines, cotton gins, &c.
Burnell, Martin & Co., 5 & 6, Great Winchester Street Buildings	Algoa Bay, Natal, Mau- ritius, and Yokohama	Apparel, hardware, dra- pery, woollens, blan- kets, and general
Burnes, J., & Son, 138, Leadenhall Street	Aden, Cape and various	Steam and other coals
Burnuss, James W., Dunster House, Dun- ster Court	Shanghai, &c	Fibre, minerals, and coals
Burr, D., MacGibbon & Co., 204, Up. Thames Street; also Falkirk, N.B.	Various	Ironware and milled plates
Byrne, R., & Co, 137, Fenchurch Street and Cardiff	Mediterranean, Black Sea, Baltic, &c.	Coals and iron
Calway, Bartholomew, 58, King William Street	Adelaide	Hardware
Campbell, John, & Co., 15, Austin Friars	East Indies	Hardware, machinery, cottons, woollens, and piece goods
Carnegie, A., 16, Bishops- gate Street Within	Galatz, Ibrail, Malta, Constantinople, Sy- ria, and Odessa	Hardware, earthenware, ironware, and general
Carr, C., & Co., 14, Bishopsgate Street Within	Mediterranean, Conti- nental Ports, Ame- rica, China, and Japan	Manufactured goods, ma- chinery, &c.
Co., 9, Idol Lane, Tower Street	Cape, Mauritius, Indies, Central and South America, and China	Colonial produce, wines, beer, cotton goods, arms, ammunition, and general merchandise
M. Chatwood, Samuel, 12, Cannon Street	Various	Fire-proof safes
Child, Hornby & Co., 27, Lombard Street	West Coast of Africa, India, Egypt, and North and South America	Cotton manufactures, hardware, coals, &c.

Warehousemen and Shippers.	Ports.	Manufactures.
Chinnery & Johnson, 67½, Lower Thames Street, and Folkstone	Paris, Boulogne, Dieppe, and Dunkirk	Leather, cottons, silks, woollens, haberdash- ery, linens, steel, and iron
M. Chisholm, J., Son, & Co., 44, Mark Lane	Various	Agricultural implements and machinery
Chollett, M., & Co., 2, Ingram Court	Trieste, Adriatic, and various	Manchester, Sheffield, and Birmingham manu- factures, and pre- served provisions
M. Chubb & Son, 37, St. Paul's Churchyard	Various	Iron safes and locks
M. Churchill, Chas., 28, Wilson Street	Australia and various .	American hardware
Clauson, Charles, 157, Fenchurch Street	Mediterranean	Metals, &c.
Clay, Cooper & Co., 3, Adelaide Place, Lon- don Bridge	New Zealand, Alexan- dria, Black Sea, and various	Metals, hardware, and general merchandise
Cobb, A. B., & Co., 34, Great St. Helen's	Australia	Drapery, haberdashery, machinery, &c.
Cohen, Aaron, & Co., 161, Great Dover Street	America and various	Rags, metals, and general
Cohen, D., 41, Sun Street, Finsbury	Australia, Continent,&c.	Metals
Cohen, Mylius, 57, Gracechurch Street	Continent and various .	Metals, &c.
Coles, Brown, Andrews & Co., Levant House, St. Helen's Place, and 19, St. Helen's Place	China, Japan, and India	Metals, cottons, linens, woollens, piece goods, and general
Colla, D. M., 4, Cullum Street	Greece	Hardware, glass, brush- ware, woollens, and general
Colonial Company (Lim.), 16, Leaden- hall Street	West Indies	Apparel, saddlery, hard- ware, and general
M. Colt's Fire Arms Company, 14, Pall Mall	India and Colonies .	Revolvers, &c.
Colville, E., 9, Fen- church Buildings	West Indies	Hardware and estate
Compton & Read, 8, Moorgate Street	East Indies, New Zealand, China, and Australia	Apparel, cottons, ma- chinery, and hardware
Compton, H., & Co., 148, Fenchurch Street Compton, Wohlgemuth & Hardness, 4, Coal Exchange, Lower	India, Africa, and all other parts Various	Pewterware, tin-foil, and tea-lead Coals
Thames Street M. Copeland, W. T., & Sons, 160, New Broad Street	East Indies and Colo- nies	Glass, china, and earthen- ware

Warehousemen and Shippers.	Ports.	Manufactures,
Corcos, Abraham, 45, Houndsditch Cory Bros. & Co., 150,	Mogadore Lisbon, Malta, Port	Manchester goods, cloth, earthenware, and china Coals
Leadenhall Street Cotesworth & Powell, 16½, St. Helen's Place	Said, &c. Australia, China, South America, and East Indies	Cottons, iron, general and British manu- factured goods
Coulon, Berthoud & Co., 21, Threadneedle Street	Centinent and various	Oils, colonial produce, and metals
Coulthard & Co., 12, Abehurch Yard	East Indies	Metals, hardware, &c.
Cowderoy & Rainbow, 5, New London Street	China and East	Apparel, machinery, cot- ton, and general
Cox, Rowland, 3 and 4, Great Winchester Street Buildings	Brazils	Hardware and general
M. Crane, T. H., 3, Royal Exchange	India, Australia, &c	Guns
Crawford, Colvin & Co., 71, Old Broad Street	East Indies and China	Hardware, metals, Man- chester goods, and general
M. Croggon & Co., Al- bion Wharf, 10, Upper Thames Street	Various	Patent felt, zinc, gal- vanized iron, &c.
Cuadra, B. de, 43, Lime Street	Australia, New Zealand, East Indies, and China	Wearing apparel, apothe- caries' ware, drapery, haberdashery, earthen-
Cunningham & Co., 480, Oxford Street	All parts of the world	ware, and hardware Sewing, sawing, metal- cutting machines, &c.
Cunningham, R. S., 158, Leadenhall Street	India, Australia, Cape, and South America	Metals, hardware, In- dia rubber, patent
Curtis, J. L., Palmer- ston Buildings	New Zealand and Australia	paints, and general Machinery, hardware, and general merchan- dise
Culbill, Son & De Lungo, 103, Cannon Street	East Indies, &c	Metals, railway iron, &c.
Da Silva & Co., 26, Bride Lane, Fleet Street	Various	Hardware, medicines, and general merchan- dise
Dadabhai, Naoroji & Co., 32, Great St. Helen's	East Indies	30 11 1
Daniell & Co., 25, Old Broad Street	East Indies	Cottons, woollens, metals, and general
Daniels, F., 2, Riches Court	United States	Railway materials, hard- ware, and general goods
Dart, J. H., & Son, 3 and 4, Great Win- chester Street Build- ings		British manufactured goods, metals, &c.

Warehousemen and Shippers.	Ports.	Manufactures.
M. Darton, F., & Co., 72, St. John Street Daunt & Senior, 27,	San Francisco, Ceylon, and Mauritius India	Metals
Clement's Lane Davidson, R. E., & Co., 6, Crosby Square	Spain, Canaries, and various	Linens, iron, machinery, earthenware, and gene- ral merchandise
Davidsons & Co., 9, Gracechurch Street	West Indies	Hardware, machinery.
Davis, D., & Sons, 15, Leadenhall Street	Various	Ferndale and 'Davis Merthys' steam coals
Davis, W. B., 106, Leadenhall Street	Bombay, Calcutta, Ma- dras, China, and West Indies	Hardware, glass, cottons, Manchester goods, and general
De Lizardi, F., & Co., 124, Cannon Street	West Indies, America, and Spain	Linens, cottons, iron, medicines, glass, beer, and general
De Rass & Son, 17, Fenchurch Street	Cape of Good Hope, Australia, West In- dies, &c.	Woollens, cottons, haber- dashery, hardware, earthenware, wines, spirits, &c.
De Salamanca, J., 11, Leadenhall Street	Spain and various .	Iron, coals, railway plant, and general merchan- dise
De Salles, J., & Co., 28, Fenchurch Street	Brazil and River Plate	Cottons, linens, hard- ware, earthenware, glass, beer, ales, and machinery
Deacon, E. & A., 34, Rood Lane	Hong Kong, China, and India	Pig lead
Deane & Co., 46, King William Street	Australia and various	Ironmongery, &c.
Deane, J. & A., 2 and 3, Arthur Street East	East Indies and Colonies	Saddlery, harness, ma- chinery, &c.
Deane, J., & Sons, 30, King William Street	Various	Arms, &c.
Deare, F. D., & Co., 19, Coleman Street	Algoa Bay and Cape of Good Hope	
M. W. Defries & Sons, 147, Houndsditch	Sydney, New Zealand, Indies, China, Egypt, and Turkey	Hardware, chandeliers, glass, earthenware, &c.
Dennis Bros. & Co., 24, Martin's Lane	Continent and various	Tin plates, metals, &c.
Dent, Palmer & Co., 11, King's Arms Yard	China and India	Manchester goods, me- tals, &c.
Dickenson, Rose & Co., 3, King William St.	East India and China	Manchester goods, wool- lens, metals, and soft goods
M. Dixon, James, & Sons, 37, Ludgate Hill	India and various .	Electro-plate, Britannia metal, and shooting tackle
Dobree, G., & Sons, 6, Tokenhouse Yard	West Indies and various	Estate stores and ma- chinery
M. Dolland & Co., 1, Ludgate Hill	Various	Telescopes and optical instruments

Warehousemen and Shippers.	Ports.		Manufactures.
M. Donald, Altreg & Co., 33, Cornhill	India and variou	ıs .	Machinery and railway
M. Doukin & Co., Blue Anchor Road, s.e.	Colonies and var	ious .	Machinery
M. Dougall, J. D., 59, St. James Street, s.w.	India and Colon	ies .	Guns, &c.
M. Doulton, Henry, & Co., 63, High Street, Lambeth, s.	Various .		Pottery, bricks, and tiles
M. Doulton, J., Bros., & Co., 28, High Street, Lambeth, s.	Various .		Earthenware
Duncan, George, & Co., 2, East India Avenue	East Indies .		Manchester goods, me- tals, and general. (Ship insurance brokers)
Dunell, Henry J.	Cape		Hardware, soft goods, and general
Dunham, William, 48, Mark Lane	Australia, Cape Hope, Canada France, Germa Russia	, India,	Flour-mill machinery, mill-stones, hardware, and lubricators
Dunlop, George, & Co., 9a, New Broad Street	Continent, East and Ceylon	Indies,	Woollens, machinery, hardware, colonial pro- duce, and general mer- chandise
Dunn, W., & Co., 6, Lime Street Square	Cape, Natal, In goa Bay, Chir tralia, &c.	dia, Al- ia, Aus-	Manchester goods, wool- lens, hardware, and general
Durrant, A., 30, Great St. Helen's			Spirits, beads, earthen- ware, iron, grocery, and cotton goods
Duthie, W., 1, Wall- brook Buildings	Cape		Cottons, earthenware and woollen manu- factured goods
Dymes, Daniel D., 9, Mincing Lane	Madras		Hardware, machinery, iron, Manchester goods, &c.
Eames & Co., St. Mi- chael's House, Corn- hill	America .		Iron
Earnshaw, Worsley, & Co., 17, Fenchurch Street	West Indies		Manchester goods, hard- ware, &c.
East India Railway Company, Moorgate Street	East Indies		Railway plant, engines &c.
M. Ely Brothers, 254, Gray's Inn Road	East Indies, Japan, and v	China,	Ammunition and arms
Elin, John, & Co., 3 and 4, Great Winches- ter Street Buildings			Cotton goods, provisions arms, apparel, ammu nition, and general
Elt, Charles, 4, St. Helen's Place	East Indies .	•	Manchester and piece goods, metals, paints oils, &c.

Warehousemen and Shippers.	Ports.	Manufactures.
Enthoven, H. J., & Sons, 17, Gracechurch Street, and Lead Works, Upper Ord- nance Place, Rother- hithe	Mediterranean & South of Europe	Cottons, linens, colonial produce, and metals
Eschmann Brothers & Walsh, 12, St. Bar- tholomew's Square, St. Luke's	United States and Continent	India-rubber surgical in- struments, &c.
M. Evans & Wormull, 6, Dowgate Hill W. Evered, R., & Son, 50, Bishopsgate Street Without	India, Australia, United States, &c. Australia, &c.	Surgical instruments and appliances Hardware
M. Everitt, Allen & Sons, 118, Cannon Street	America, Russia, &c	Tube wire and metals
Fanfax, William Henry, 74, Little Britain	Various	Hardware
Faithful, Cookson & Co., 9p, New Broad Street	Various	Iron and iron ore
Falkland Islands Com- pany, 39a, Grace- church Street	Stanley, Falkland Isles	General merchandise, coals, &c.
W. Farmiloe & Sons, 34, St. John Street	Various	Lead, glass, oils, and
W. Farrow & Jackson, 16, 17, and 18, Great Tower Street; 1, Harp Lane; 91, Mansell St.; and 8, Haymarket	Various	Iron wine bins, beer engines, bottling and corking machines, and all requisites for bot- tling wines and spirits
Faring & Co., 36, Queen Street	India and others	Tin and Japan ware
Fenn & Ellis, 32, Bo- tolph Lane	West Coast of South Africa, &c.	Cotton goods, provisions, ammunition, and gene- ral
Field, O., & Co., 76, Mark Lane	United States and North America	Drugs, dye stuffs, che- micals, colours, metals, paint, gums, East In- dia produce, oil, oil- seed, and sundries
Findlay, Denham & Brodie, 31, Great St. Helen's	Australia, New Zea- land, Cape Town, Algoa Bay, and Van- couver's Island	Iron, hardware, soft and piece goods, groceries, and general merchan- dise
Findlay, John, & Co., 10, Laurence Pountney Lane, Cannon Street	Beaunos Ayres	Machinery, hardware, printing material, and general merchandise
Fleming, Seymour & Co., 18, St. Helen's Place	Russia and Alexandria	Metals and general
Forbes, D. W., & Co., 40, Upper East Smithfield	Various	Ship's ironmongery
Forbes, J. A., 8, Lime St. M. Fox, Walter, & Co., 13, High Holborn	East Indies and China Australia	Hardware-earthenware Wire-work sieves

Warehousemen and Shippers.	Ports.	Manufactures.
Fraser, D., 8, New Broad Street	Russia	Iron, machinery, coals,
Freeth, S., & Co., 60, Gracechurch Street	India, &c	Manufactured iron
Froom & Co., 8, New Broad Street	Russia	Machinery and iron
Frost, J. E., 85, Gos- well Street	Colonies, &c	Steam cocks and water
Fry, James, & Co., Gresham House	Various	Metals
Galbraith, H. J., & Co., 9, Crosby Square	China	Manchester goods, iron, glass ware, &c.
M. Gann, Jones & Co., 171, Fenchurch Street	Colonies	Sewing machines, shirts, collars, clothing, &c.
Gaminara, & Co., 3, New London Street	South America, South of Europe, &c.	Manchester and Sheffield goods and general
Garden & Son, 200, Piccadilly	East Indies	Arms, ammunition, sad- dlery, &c.
Gardner, Joseph, & Sons, 5, New London Street	South Russia and Tur- key	Machinery and general
Gardner, R., 46, Lime Street	West Indies	Machinery and estate
Garnham, J. B., 10, Lau- rence Pountney Lane	Various	General merchandise, hardware, and ma- chinery
Gavin, Alexander, 9, Moorgate Street	Baltic	Colonial produce, oils, and metals
Geiselbrecht, J. C., 8, Leadenhall Street	Baltic, North of Europe, Australia, New Zea- land, Cape, East In- dies, and China	Drugs, chemicals, metals and general merchan- diso
Gellaty, Hankey, Se- well, & Co., 109, Leadenhall Street; and Manchester	India, China, and general	Cottons, woollens, hard- ware, and general
Gerber, Chrestien & Co., 59, Mark Lane	Rangoon, Akyal, &c	Manchester staple, co loured yarns, and cor rugated iron
M. Gerich, Samuel, & Co., 22 to 30, Buttes- land Street, N.	Colonies and various .	Patent spring hinges
Geelgud, H., 65, Grace- church Street	Continent, &c	Machinery, railway plant and iron
Gillesby & Scott, 2, Brabant Court, Phil- pot Lane	West Coast of Africa, &c.	Coals
M. Gillett & Bland, Steam Clock Factory, White Horse Road, Croydon	Australia, China, India, South America, Tur- key, Spain, Canada, Greece, Russia, &c.	Church, turret, stable house, and musica clocks of every descrip- tion; bells and paten
M. Gillott, J., & Sons,	Various	chiming machines Steel pens
37, Gracechurch St.		

Warehousemen and Shippers.	Ports.	Manufactures.
Ginham, John, J., 61, Moorgate Street	Various	Iron and wood houses, wire netting, fencing, and hurdles
Gospel Oak Iron Com- pany, 74, King Wil- liam Street	Australia and various .	Galvanized iron
Gossell, Otto, 22, Moor- gate Street	Continent	Rails, iron, steel, and general
W. Graetzer & Her- mann, 73, Alderman- bury	All parts of Europe, America and Colo- nies, East Indies, and China	Glass, lead, colonial pro- duce, cottons, woollens, and linens
Grant, James (late Smith & Grant), 17, Gracechurch Street	East Indies, &c	Manchester goods, me- tals, hardware, and general
Grantoff, B. A., & Co., Jeffry Square	North of Europe, Russia, South America, East Indies, and China	Machinery, hardware, and English manufac- tures in general
Gray, Beavis, & Co., 58, Lombard Street	Continent	Coal-tar products, chemi- cals, and colonial pro- duce
Gray, C. W., & W., 31, Great St. Helen's	West Indies and various	Cottons, linens, wearing- apparel, machinery, and estate stores
Green & Holland, 15, 16 & 17, Coal Exchange	Various	Coals
Green, J., 35 & 36, Upper Thames Street	Cape and various	Earthenware, glass, and
Green, Thos., 20, Great Winchester Street	Various	Iron and hardware
Gregson & Co. (East India and China agents), 14, Austin friars	East Indies, China, and others	Metals, cottons, woollens, linens, hardware, and general
Greig, G., 3, George Yard, Lombard Street	Cape of Good Hope and West Coast of Africa	Hardware, apparel, ma- chinery, cottons, and general
Grice, Wm., & Co., 21, East India Chambers	Melbourne, Adelaide, New Zealand, Canter- bury, Otago, and others	Soft goods, silks, beer, hardware, machinery, wines, spirits, boots and shoes, and general
Grieves, James, & Co., 43, Mincing Lane	Calcutta	Metals in general
Griffith & Co., 84 and 133, Cannon Street	Iron to all parts of the world	All kinds of malleable iron, Scotch pigs, steam engines, machinery, and metals
Griffiths, Williams & Co., 2, Crown Court, Philpot Lane	Various	Copper and yellow metal
Grindlay & Co., 55, Parliament Street Guest, Sir John, & Co. (Bart.), 13, King's Arms Yard	East and West Indies and China Various	Hardware, machinery, cottons, and linens Iron

Warehousemen and Shippers.	Ports.	Manufactures.
M. Gwyne & Co., Essex Street, Strand	East and West Indies, Japan, China, De- merara, South Ame- rica, and various	Machinery for works of irrigation, drainage, &c., for dry docks, canals, plantations, sheep washing, and manufacturing purposes
Hadden, James A., & Co., 25, Fenchurch Street	Ceylon and East Indies	Ironware and general goods
Hagedom, Frederick Wm., 150, Leaden- hall Street	Hong Kong and China	Manchester and woollen goods, iron, and gene- ral
Hall & Holtz, 6, St. Benet's Place	China	Apparel, machinery, cot- tons, &c.
Hall, Edward James, 144, Minories; and 6, America Square	West Indies, Vincent, and various	Ironmongery and ma- chinery
Hammond, C., 6, Bil- liter Square	West Indies	Machinery, guano, estate stores, and general
M. Hampson & Bett- ridge, 47, 48 & 49, Old Bailey	All ports	Bookbinder's machines presses, and tools
M. Handyside, A., & Co., 32, Walbrook	East Indies, China, Japan, Russia, Swe- den, Norway, and the Colonies	Iron bridges, roofs, en gines, boilers, and al classes of iron work
Hanson, Henry Allix, 23, Great Winchester Street	Constantinople	Machinery and general
Harbottle, J., 1, Alderman's Walk	Cuba, Spain, Russia, and Mediterranean	Iron, coals, colonial pro duce, and general
Hardford & Bristol Brass Battery and Wire Company, Dow- gate	Various	Ingot and sheet brass copper, and brass wir
Hanaden, S., & Co., 3, Chapel Place, Poultry	India	Stationery, books, plate ware, and bronze goods and general merchan dise
M. Harrild & Sons, 20, Farringdon Street	Various	Printing presses, ma chines, type, and print ing materials
Harris, Scarfe & Co., 28, Martin's Lane, Cannon Street	Adelaide, &c	Manchester and Sheffiel goods and general
Harrison, J., & Co., Skinner Place, Size Lane		Manchester and Bradfor goods, iron, and ma
Harrold Brothers, 32, Great St. Helen's	Adelaide	Hardware, &c.
Harvey, Brand, & Co., 37, New Broad Street	Japan	metals, &c.
Harward, W. T., & Co., 2, East India Avenue		Scrap-iron. (Shipbroker

Warehousemen and Shippers.	Ports.	Manufactures.
Harwin, R. (at Harvey & Greenacre's), 85, Gracechurch Street	Cape, Natal, and West Indies	Woollens, cottons, haber- dashery, and hardware
M. Hasluck, L., George Yard, Lombard Street	Colonies and India .	Watches and clocks
Herdeman, Hayton & Co., 13, Old Jewry Chambers	Cape	Fancy goods, general mer- chandise, machinery
Heuitzmann & Rochu- sen, 23, Abchurch Lane	Africa and West Coast	and drapery Cotton goods, apparel hardware, and provi- sions
Held, Charles, & Co., 63, Great Tower Street	America and Continent	Metals, cottons, &c.
Henderson, George, 7, Mincing Lane	East Indies, China, and others	Metals and Manchester goods
Henderson, George, 58, Lombard Street	Leghorn, &c	Iron, coal, paints, and various. (Ship insur- ance broker)
Hendewerk, R., 79, Mark Lane	France, Baltic, and North of Europe	Glassware, iron, cement, and provisions
Heny, Michael, 7, South Place, Finsbury	Jamaica, West Indies, and South America	Hardware, cottons, linens &c.
M. Hernulewicz & Co., 43, Fish Street Hill	Colonies	Iron manufactures for farming purposes, and fencing wire
M. Heulett & Co., 55 and 56, High Holborn	Rio, Singapore, &c	Gas fittings
Hezerdahl, Schonberg & Co., 10, Cornhill	America	Iron and metals
Hickie, Borman & Co., 127, Leadenhall Street	Continent, East Indies, China, &c.	Coals, iron, soft goods and general
Higgin, E., & Co., 2, East India Avenue	East Indies and China	Ironwork, woollens, ap- parel, cottons, beer machinery, hardware and railway materials
M. Higgs & George, 60, Cannon Street	Various	Ironmongery
M. Hill & Smith, 97, Cannon Street, and Staffordshire	Australia, New Zealand, and Cape	Iron and wire fencing, hurdles, and gates of every description
Hill, Richardson & Wright, 35, Great St. Helen's	West Indies, Australia, Spain, and various	Metals, manufactured goods, and general
Hillier & Co., 46, Lime Street	Continent, United States and Australia	Hardware, firearms, cot- ton goods, and general
Hinton Bros. & Co., 80, Old Broad Street	Mediterranean and America	Iron and various
Hitchcock & Co., 38, St. Mary Axe	Continent	Metal
Horne & Thornthwaite, 122, Newgate Street	North and South America	Philosophical instru- ments
Houghton, Smith & Co., 2, Jeffrey's Square	East Indies and various	Hardware and Manches- ter, &c.
Howard, Alfred, 3, Leadenhall Street	Various	Yellow metal, zinc, iron tin plates, and copper

Warehousemen and Shippers.	Ports.	Manufactures.
Howden, Alexander & Co., 19, Birchin Lane Howe Machine Co., 64,	East Indies and South America East Indies, Australia,	,
Regent Street	and various	
Hubband, John, & Co., 4, St. Helen's Place	Russia	Machinery, iron, and general
Hughes Brothers, 30, Gracechurch Street	Continent	Hardware and general
Hughes, Henry, 83, Gracechurch Street	Various	Metals
Hughes, J. W., 24, Leadenhall Street	United States and	Metals and tin plate
Holworthy, J. M., & Co., 30, Great St. Helen's	Australia and various	Hardware
Hooper, A. D., & Co., 40, Old Broad Street	China and Japan .	Metals and hardware
Hooper, John R., & Co., 32, Great St. Helen's	East Indies, China, and Japan	Manchester and Bradford goods, metals
Hoperaft & Broadwater, 3, Billiter Square	Australia, New Zealand, China, &c.	Manchester goods, iron and general
Hurndall, H. L., 2, Skinner's Place, Size Lane, Bucklersbury	New Zealand	Agricultural implements Manchester goods hardware
Ibbotson Brothers, 1, Skinner's Place, Size Lane, Bucklersbury	Various	Steel and iron files, and engineers' and othe tools
Ilbery, J., 23, Beer Lane	Australia, America, Cape, India, China, Japan, Canada, and various	Oilman's stores, Man chester goods, hard ware, and general
Irving, T., & Co., 17, Gracechurch Street	Australia, Monte Video, New Zealand, and various	Manchester goods, hard ware, metals, and general
James & Shakspeare, 10, Austin Friars	Australia, New Zealand, East Indies, China, and United States	Metals
James, Walter, 10, St. Benet's Place, Grace- church Street	East and West Cape, China, Australia, and various	Machinery and general
Jamieson, Wm., & Co., 9. Fenchurch Street	East Indies, China, and Japan	Manchester goods, me- tals, machinery
Johnson Brothers, & Co., 6, Waterloo Place, Pall Mall	Various	Iron fences, &c.
Johnston, Charles, & Co., 150, Leadenhall Street	Brazils and North America	Machinery, metals, and general
Johnson, Matthey, & Co., 77, Hatton Garden	English Colonies	Metals, &c.
Jones, Scott & Co., 62, Basinghall Street	Melbourne	Hardware and general
Joshua Brothers & Co., 9, Great Winchester Street	Melbourne and various	Metals, &c.

Warehousemen and Shippers.	Ports.	Manufactures.
Jourdain & Co., 10, Austin Friars Kaltenbach & Schuntz, Alderman's Walk, and Liverpool, Ham-	East Indies, Mediter- raneau, South of Europe, and various East Indies, China, and Japan	Pig iron and general merchandise Machinery, metals, and general
burg, and Bordeaux Kerr, George, & Co., 6, Great Winchester Street Buildings	Australia and New Zealand	General
Kirk, James, & Co., 27, Mincing Lane Kleeberg, Martin, 21,	Spain	Railway materials and general merchandise Bullion
Throgmorton Street Knowles & Foster, 42, Moorgate Street	Portugal, Brazils, and China	Arms, &c.
Krauss, Klein Paul, 15, Tower Hill	Continent and various .	Guns and engineer's stores
Kreeft, Howard & Co., 124, Fenchurch Street Kruger, Aug., 34,	Continent	Hardwere and machinery Iron ware, &c.
Throgmorton Street Kuhuer, Hendschel, &	West Indies.	Machinery, &c.
Co.,145, Cannon Street Laird, J. W., 6, Bishops-	Wellington, Australia,	Arms, &c.
gate Street Without Lampson, C. M., & Co., 64, Queen Street	India, and China United States	Railway metals
Lang, J., & Co., 32, New Broad Street	Cape	Arms, &c.
Gresham House	Australia	Machinery and hardware
Lawrence, Clark & Co., Windsor Chambers, 20, Great St. Helen's Lawson, P., & Son, 2, Budge Row, Cannon Street	East Indies, China, Australia, and Hono- lulu Australia, New Zealand, West Indies, Cape Town, France, Ger-	Hardware, British manufactured goods, and general merchandise Agricultural and horticultural implements, &c.
Lazard, E., & Co., 20, King's Arms Yard,	many, &c. Baltic	Machinery, hardware, &c.
Moorgate Street Lazarus, Lewis, & Sons, 29, Great St. Helen's	India, &c	Metals
Leaver & Breege, 25 & 26, Houndsditch	Colonies and various .	Birmingham and Shef- field goods
Leaver, J. R., 16, Water Lane	West Coast of Africa .	Manchester, Sheffield, and general goods
Leddell, Henry, & Co 24, High Holborn	Indies, Australia, New Zealand, Cape, and Continent	Britannia metal, &c.
Leech, Harrison & For- wood, 30, Great St. Helen's; Liverpool and Manchester	East Indies, China, Japan, Australia, &c.	Manchester goods, hard- ware, &c.

Warehousemen and Shippers	. Ports.	Manufactures.
Lent. J. O., 106, Cannon Street	Various	Manufactured iron, &c.
Lepage, R. C., & Co., 1, White Friars Street	Calcutta	Machinery, &c.
Leon, Lewis, 23, New Broad Street	New York and West Indies	Hardware and general
Levich, Joseph, & Son, 9, King's Arms Yard	Cape and Algoa Bay	Hardware
Levich, James, 9, King's Arms Yard	Sydney	Hardware
Levin, M. L., 1, Bevis Marks	Africa	Fire-arms, &c.
Lias, H. J., & Sons, 7. Salisbury Court, Fleet Street	Australia, East and West Indies, Cape, &c.	Plated ware and cutlery, &c.
Lindo, Daniel, 35, Great St. Helen's	West Indies	Iron, hardware, &c.
Lindley, Arthur, & Co., 31, Great St. Helen's	Spain	Hardware and general
Linnington, A. H., 58, Fenchurch Street	Nevis and St. Kitts .	Iron and general
Locke, Lancaster & Co., Peter's Chambers, Cornhill	America, Calcutta, East and West Indies, and China	Tea, pig, white, red, and sheet lead, and pipes
Lockhart, Toger & Co., 3, Storey's Gate, Westminster	Continent and various .	Wrought iron tubes, chains, anchors, and heavy iron goods
London Warming and Ventilating Company (Lim.), 23, Abingdon Street, Westminster	Trieste, Paris, Brussels, St. Petersburgh, &c.	Stoves, furnaces, and warming apparatus
Lonergan F. W., 22, Lime Street	Central America	Iron, &c.
Low Moor Iron Com- pany, 98, Cannon Street	Copenhagen, Amster- dam, and Hong Kong	Iron, bars, and plates
Macfarian & Co., 17, Langbourn Cham- bers, Fenchurch Street	East India and China .	Machinery, hardware, and general
Macfarlane, W., & Co., 84, Upper Thames Street	India and Australia .	Ornamental cast-iron work, rain-water cast- ings, &c.
Mackay, Gellier & Co., 1, Leadenhall Street	Australia	Motals and general
Mackaught, Robertson & Co., 1, Bankend, Bankside	Various	Iron sheets and plates
Madox & Co., 36, Mark Lane	Mediterranean and South America	Metal ware, machinery, &c.
Galcolm, Brunker & Co., 14, St. Mary Axe	India, China, and Japan	Manchester goods, me- tals, and general
Manning & Co., High Holborn	Australia	Iron fencing, hurdles, and general merchan- dise

Warehousemen and Shippers.	Ports.	Manufactures.
Mappin & Webb, 71 & 72, Cornhill	India, Australia, and various	Cutlery, &c.
Marshall & Co., Sussex Place, Leadenhall Street	New Zealand and Africa	Ironmongery
Matveieff, C., & Co., 32, Great St. Helen's	China and Russia .	Machinery, &c.
Mavro, Valieri & Co., 112, Gresham House	Russia, Danube, Levant, and South of Europe	Metals, hardware, &c.
Malwell, Robert, & Co., 9, Mincing Lane	Madras Coast	Iron and Manchester goods
Maxondoff, A., 14, Union Court, Old Broad Street	Russia, Mediterranean, and United States	Metals, &c.
May, G., & Co., 17, Finsbury Circus and 1, East India Avenue	East Indies	Manchester goods, me- tals, &c.
McAndrew, W., & Sons, 85, Gracechurch Street	Spain, Azores, Portugal, and Vauture Ports	Hardware, iron goods, agricultural imple- ments, &c.
McArthur & Co., 23, Rood Lane	Various	Metals and iron
McComas, Thomas, & Co., 55, Old Broad Street	Port Phillip	Hardware, metals, &c.
McEvan, James, & Co., 122, Cannon Street	Melbourne, Sydney, and New Zealand, part	Iron, hardware, &c.
McMaster, J., 25, East- cheap	Cape	Hardware, &c.
Meadows, T., & Co., Milk Street	United States, Australia, and other ports	General merchandise, railway plant, ma- chinery, &c.
Mears and Stainbank, 267, Whitechapel Road	Canada, United States, America, West Indies, Australia, India, and all parts	Bells
Meier, C. G., & Co., 3, Brabant Court, Phil- pot Lane	China, East Indies, and various	Machinery, hardware, &c.
Menasce, T. L., Sons, & Co., 1 and 2, Great Winchester Street Buildings	Egypt	Manchester, Birming- ham, and general goods
Merryweather & Sons, 63, Longacre, and York Street, Lambeth	Various	Fire engines and general machinery
Merton, H. R., & Co., 117 and 118, Leaden- hall Street	East Indies, Australia, and various	Metals, hardware, &c.
Michell, R. R., & Co., 2, Crown Court, Phil- pot Lane	Various	Block, bar, and other tin
Miles Brothers & Co., 79, Gracechurch Street		

Warehousemen and Shippers.	Ports.	Manufactures.	
Miles, Gould, Druce & Co., 29, Upper Thames	Various	Iron	
Street Millar, W., 49, Fenchurch Street Montefiore John, 4, St. Benet's Place, Grace-	Mediterranean and Australia West Indies and America	Hardware, machinery, iron, lead, and shot Hardware, machinery, &c.	
church Street Montigny, Reini De, 106, Cannon Street	China	General	
Moore & Manby, 3, Billiter Square, and	China, Australia, and various foreign go-	Iron	
Dudley Morton, J., & Co., 6 and 7, Sherborne Lane	China, New Zealand, Australia, Japan, and various	General, hardware, iron, and metal	
Morewood & Co., Leadenhall Street Morgan, T., & Son, New Street, Bishop-	Various	Galvanised iron roofs, sheet iron, &c. Native implements, arms, &c.	
gate Street Morrison, A., & Co., 10, Austin Friars Mort, W., & Co., 155, Fenchurch Street	New Zealand and West Indies Sydney	British manufactured goods, metals, &c. Machinery, iron, &c.	
Mortimer, H. H., & Co., 10 and 25, Bush Lane, and Birming- ham	Hong Kong, Australia, &c.	Hardware	
Morum Brothers, 1, Guildhall Chambers	Cape	General	
Muntz Metal Company, 23, Rood Lane	Various	Metals	
Murdoch, H. H., 30, Great St. Helen's	East Indies	Machinery, hardware, &c	
Naoroji, Dadabhai & Company, Great St. Helen's	India	Manchester goods, ma- chinery, &c.	
Nash, Samuel, & Co., 137, Fenchurch Street and at Cardiff	United States	Metals	
Naylor, Benyon & Co., Palmerston Build- ings, Old Broad Street	Continent and United States	Railway materials, iron, steel, &c.	
Neilson, C., & Sons, 12, Great St. Heleu's	West Indies and various	Iron, &c.	
Netter, Charles, & Co., 31, Bush Lane	Egypt and Syria	Machinery, Birmingham goods, iron, tools, &c.	
Newby, E. H., 39A, King William Street	East Indies	Machinery and rifles	
Nicholls, T., & Co., New City Chambers,	Cape and various .	Hardware, &c.	
Bishopsgate Street			

Warehousemen and Shippers.	Ports.	Manufactures.	
Nicolson Brothers, 5, Jeffrey's Square	Australia, New Zealand, Rio De Janeiro, Cal- cutta, Madras, Bom- bay, Colombo, Yoko- hama, Hong Kong, Cape Town, and Na- tal	Hardware	
Norrington, Pitts & Co., 23, Great St. Helen's	Various	Iron	
Novelli & Co., 2, Crosby Square	Spain, Egypt, and United States	Metals, &c.	
Oakes Brothers & Co., 26, Nicholas Lane	Madras, East Indies, China, &c.	Hardware, &c.	
Oakes, T. & Co., 10, Austin Friars	East Indies and China	Hardware, metals, &c.	
Orme, Frederick, Ethel- burgha House, 70 and 71, Bishopsgate Street Within	Continent	Hardware and machinery	
Osborne, C. S., Great Garden Street, White- chapel	New York and Moscow	White metal and brass castings	
Owen, Richardson & Co., 3, Newman's Court, Corrhill	Baltic and North of Europe	Machinery, hardware, &c.	
Palmer, Edward S., 8, Cullum Street	East Indies, China, South America, &c.	Machinery, arms, &c.	
Palmer, J. N., 22, Leadenhall Street	Australia	Ironwork and general	
Panulcillo Copper Com- pany (Limited), 25, Great St. Helen's	Coquimbo	Tools and machinery	
Parkes, J., & Co., (Lim.), 152, Upper Thames Street	Various	Hardware	
Parry, Lovel & Co., 122, Cannon Street	Continent and Africa .	Iron, tin - plate, and general	
Pavia, Charles, 83, Lower Thames Street	Italy	Tin-foil	
Peacock, C. G., 1, Bishopsgate Street	North and South America	Cutlery, &c.	
Peal & Chattoch, 149, Upper Thames Street	Various	Metal, tin-plates, &c.	
Perkins, E., & Co., Lombard House, George Yard, Lom- bard Street	America	Metals, &c.	
Peters, G. D., & Co., 9, Bunhill Road	Australia, West Coast of Africa, West In- dies, China, and Japan	Hardware, machinery, and engineers' stores	
Picard, Joseph, & Co., Coffee Planter's Hall, Farringdon Street	Colonies and various .	Coffee machines	

Warehousemen and Shippers. Ports.		Manufactures.	
Pini, J., Roncorini Brothers, 22, College Hill	River Plate and South America	Hardware, &c.	
Pinto, Leete & Nephews, 24, Moorgate Street	Spanish and Portuguese Settlements, Brazils, and West Coast of Africa	Machinery, hardware, &c.	
Pothohier, Tilsley & Co., 150, Leadenhall Street	Cape, Brazils, Natal, and various	Machinery, railway plant, and general	
Powis, Charles, & Co., 69, Gracechurch Street Preeston, H. A., & Co.,	Australia, East and West Indies, South America, and various Portugal, Spain, and	Sewing and general ma- chinery, engines and boilers Iron, &c.	
34, Fenchurch Street Previte & Greig, 3, Newman's Court, Cornhill	Méditerranean Spain	Cornhill metals, ma- chinery	
Price Brothers, 15, New Broad Street	East Indies, China, Australia, New Zealand, and South America	Metals, &c.	
Pulling, R. W., 11, St. Bennil Place	China and various .	Iron and tin plates	
Quincey, Harcourt, 5, Bond Court, Wal- brook	Australia, Cape, East and West Indies, Russia, Spain, South America, and West Coast of Africa	Ironmongery, cutlery, hardware, Britannia metals, cast and wrought iron tubes, &c.	
Radeke, Arthur C., 15, Fish Street Hill	Italy	Hardware and general merchandise Bullion	
Raphael, R., & Sons, 25, Throgmorton Street			
Ravene, Jacob, & Sons & Co., 45 and 46, Great St. Helen's	Various	Metals	
Redruth Tin Smelting Company, Golden Heart Wharf, Dow- gate	Various	Ingot and sheet brass, copper and brass wire	
Rehder & Co., 2, Lime Street Square	China and Brazil	Metals, hardware, and general	
Relley, E. M., & Co., 502, New Oxford Street	Australia, New Zealand, South America, West and East Indies, Japan, and China	Arms, &c.	
Retter, Hugh, & Co., 14, South Street, Finsbury	Australia and various .	Hardware	
Reuss, Ernest, & Co., 39, Lombard Street	India, Russia, South America, and Conti- nent	Machinery and railway plants of every descrip- tion	
Richardson, Brothers & Co., 12, St. Helen's Place	Australia and New Zea- land	Metals, agricultural im- plements, hardware, machinery, and gene- ral	

Warehousemen and Shippers	Ports.	Manufactures.
Richardson, E., & Co., Sharp's Wharf, Wap- ping Rixon, Alfred, & Co.,	India, China, Australia, and America  Cape and Java	Hardware, hollowware, and every description of iron and steel goods Hardware and Manches-
35, Eastcheap Robertson, J. R., 2,	East Indies	ter goods Manchester goods, &c.
Billiter Square Robinson, Fleming & Co., 21, Austin Friars	Russia Baltic and North of Europe	General merchandise
Rock, T. Dennis & Co., 46, Leadenhall Street	East Indies, China, Japan, Australia, and various	Metals, hardware, and general merchandise
Rodocanachi, Sons & Co., 37, Threadneedle Street	Various	Soft goods, machinery, and general sundries
Rogers, John, & Co., 134, Leadenhall Street Rosselli, A. & E., 32, Fenchurch Street	Australia, New Zealand, America, India, China, and various Trieste, Venice, Medi- terranean, and South	Hardware, machinery, metals, and general goods Copper, &c.
Rouquette & Co., 1, Crosby Square	of Europe Mexico, United States, Continent, Spain, and various	Hardware, machinery, and general
Rownson, Drew & Co., 217, Upper Thames Street	Various	Iron, steel, zinc, nails, and hardware of all descriptions
Runciman & Scott, 5, Laurence Pountney Lane	United States and various	
Russell, John, & Co., 69, Upper Thames Street	Various .	Boiler and gas tubes
Russian Trading Com- pany, 39A, Grace- church Street	Russia	Iron, machinery, and general
Sanderson & Co., 14, St. Helen's Place	East India, China, and various	Metals, Manchester goods, and general merchandise
Sanford & Bird, 4, Cullum Street	Australia and America	Iron, tin plates, and metals
Sassoon, Davis & Co., 15, Leadenhall Street	East India, China, and Japan	Manchester and Bradford goods, metals, and general
Savage & Co., 42 and 43, Eastcheap	Spain, Australia, an Belgium	Machinery
Schiller, F., 4, St. Helen's Place	Calcutta	Hardware and machinery
Schesinger, W. J., & Co., 16, Finsbury Street	Continent	Hardware
Schroder & Co., 5, Ab- church Yard	Various	Iron and iron manufac- tures
Schuster, Son & Co., 90, Cannon Street	All parts	General and metals

Warehousemen and Shippers.	ehousemen and Shippers. Ports.	
Searle, Edward, 79,	Russia	Hardware and general
Gracechurch Street Selig, M., jun., 70 and 71, Bishopsgate Street Within	Continent	Hardware and machinery
Shand, Mason & Co., 75, Upper Ground Street, Blackfriars	India, China, and Colonies	Fire engines, fire escapes, with their appliances, &c.
Shanks, A., & Son, 27, Leadenhall Street	Australia, East Indies, and South America	Lawn mowers, hoisting machines, &c.
Shaw & Thompson, 150, Leadenhall Street Shaw, Charles, & Co.,	United States, Russia, and Egypt, &c. China, &c.	Iron and iron manufac- tures, &c. Manchester goods, me-
4, Copthall Street Shaw, J., & Sons, 33,	Various	tals, &c. Hardware
Cannon Street Shaw, Savill & Co., 34, Leadenhall Street	New Zealand	Machinery, iron, lead, &c.
Sheppard, J. & R., 106, Leadenhall Street	Continent, India, and Colonies	Hardware, machinery, &c.
Sheriff, Lindsay & Co., 3 and 4, Great Win- chester Street Build- ings	East Indies	Hardware
Siemens Brothers, 3, Great George Street	India, Australia, Egypt, Cape Colonies, New Zealand, North and South America, and various	Telegraph cable posts (iron), &c.
Sierte, King, Drop & Co., 65, Fenchurch Street	Various	Iron, &c.
Sims, Willyams & Co., 1, Queen's Street Place	Various	Copper, yellow metal
Sinclair, Peters & Co., 2, East India Avenue	All parts	Railway material, iron work, machinery, and general merchandise
Sleeman, H. B., 106, Leadenhall Street	East India and others .	Manchester goods, me- tals, &c.
Smith, Edward A., & Co., 150, Leadenhall Street	China, Calcutta, East Indies, and Japan	Hardware, &c.
Smith, Fleming & Co., 18, Leadenhall Street	East Indies and China	Manchester goods, hard- ware, and general
Smith, Gilead A., & Co., Bartholomew House, Bartholomew Lane, Threadneedle		Railroad iron, old rails Bessemer rails, &c.
Street Smith, Jas., & Co., Dunster House, Minc-		Manchester goods, machinery, and general
ing Lane Smith, R., & Co., 4, New Broad Street	India and Continent .	Steel
Smithers, Fred. Older- shaw, 37, Lime Street		Railway iron, &c.

Warehousemen and Shippers.	Ports.	Mar afactures.
Smithall, W. P., 27, Mineing Lane	Palermo	Hides, &c.
Snellgrove & Leech, 33, Mark Lane	Egypt, Russia, and	Metals, colonial and British manufactures
Spaeth, Gus. L., & Co., 78, Mark Lane	Continent and America	Iron
Spartali & Co., 25, Old Broad Street	Mediterranean, South of Europe, West Coast of Africa, Russia, and Danube	Iron manufactures and Manchester goods
Speechly & Nicholson, 74, Little Britain	Colonies and South America	ware, and general mer- chandise
Spence, J. B., & Co., 75, Mark Lane	Various	Metals
Spence, P. W., & Co., 17, Gracechurch Street	Australia and India .	Metals
Spencer, John, & Sons, 124, Fenchurch Street	Various	Hardware
Stephens & Reynolds, 31, Great St. Helen's	America	Railway materials
Stewart, Louis, Poultry Stiebel, S., & Co., 19, Abchurch Lane	India	Electro-plate jewellery Arms, hardware, machi- nery, and merchandise of every description
Stowe, H., & Co., 16, George Street, Man- sion House	East Indies, China, Canada, and others	Metals, nachinery, saddlery, hardware
Stovell & Brown, 9, Lime Street	Australia, East and West Indies, and various	Machinery, metal, estate stores, British manu- factured goods, and general
Strange, Alderson & Co., 3, St. Helen's Place	East Indies and China	Metals, machinery, hard- ware
Strode & Co., 67, St. Paul's Churchyard	Various	All kinds of gas-fittings
Sussman, J., & Co., 12, Size Lane	Continent and United States	All classes of manufac- tured and raw mate- rials
Swanzy, F. & A., 122, Cannon Street	Cape Coast Castle, and West Coast of Africa	Hardware goods
Tallack, F., Birchin Lane	Colombo and East Indies	Metals, general machi- nery, Manchester goods, and general
Tangye Brothers & Holman, 10, Lau- rence Pountney Lane	Australia, New Zealand, East and West Indies, and various	Steam-engines, steam and other pumps, pulleys, blocks, lifting-jacks, and general machinery
Tanner, Richards & Sons, 23, Thornhill Place, Caledonian Rd.	Various	Platina-pointed pens
Taylor, Jas., & Co., 82, Mark Lane	Various	Machinery

Warehousemen and Shippers.	Ports.	Manufactures.
Taylor, R. P., & Co., Adelaide Place, Lon-	Colonies, &c	Agricultural machinery
don Bridge Temperley, John, 155, Upper Thames Street	Colonies, &c	Hardware
Tennent, Charles, Sons & Co., 9, Mincing Lane	West Indies and various	Sugar machinery, &c.
The General South American Company (Lim.), 10, Palmerston Build-	North and South America	Machinery and general
ings The Gospel Oak Galvanised Iron and Wire Company, 56, Upper Thames Street	Australia, New Zealand, and various	Galvanised iron wire
The Wanzer Sewing Machine Company (Limited), 4, Great Portland Street	Australia, Canada, and others	Sewing machines
Thomas, R., & Co., 40, Gracechurch Street	Various	Hardware
Thompson, Arthur K., 31, Great St. Helen's	Mediterranean, South of Europe, West Indies, and South America	Machinery
Thomson, J., Borar & Co., 57½, Old Broad Street	Russia	Machinery, &c.
Tibbats & Sons, 44 and 45, Bishopsgate Street Without	Madagascar, Australia, and various	Iron and brass bedsteads
Tiden, Nordenfelt & Co., 34, Clement's Lane	Sweden, Russia, Ger- many, United States, East Indies, &c.	Railway materials, me- tals, &c.
Till, E. D., 26, Lom- bard Street	Various	Rails, bars, and tin- plates
Trantmann & Co., 1, New Broad Street Court	China and Japan	Manchester and foreign manufactured goods metals, and general
Treggon, Hickson & Co., 21, 22, and 23, Jewin Street	Colonies, various	Galvanised zinc and iron
Tucker, J., 3, Laurence Pountney Place, Can- non Street	Colonies and various	Machinery, hardware, and general merchan- dise
Tuckness, C., & Co., 1, Lime Street Square	South America and West Indies	Hardware, saddlery, &c.
Turton, T., & Son, 35, Queen Street	Various	Sheffield goods, steel, and files
Twycross, J., & Co., Brentford, Middlesex		Metals and general
Tyler, Hayward & Co., 84 and 85, Upper Whitecross Street	Various	Machinery
Tyler, J., & Sons, 2, Newgate Street	India and various .	Hydraulic machinery, pumps, and engines

Warehousemen and Shippers.	Ports.	Manufactures.
Tyler, John Henry, 36 and 38, Abbey Street, Bermondsey	Australia, Cape Colony, New Zealand, Mau- ritius, East and West Indies	Machinery for raising- pumps, screws, hy- draulic presses, &c.
Tyser, Y. D., & Co., 3, Crosby Square	East Indies, China, and Australia	Machinery, hardware, &c.
Ullmann, Herschhorn & Co., Fountain Court, Aldermanbury	Calcutta and Hamburg	Plated ware and general merchandise
Ullmer, Fred., 15, Old Bailey	Various	Printing machines, presses, type, and printing materials
Van Drunen, Juan, 13, Crutched Friars	Continent, China, Japan, and others	Metals, &c.
Van Weede, Jacques G., 41, Gt. Tower Street Buildings	Spain, Portugal, Mexico, and various	Machinery, &c.
Vardon, John, & Co., 3. Gracechurch Street	Various	Hardware
Vaughan, W., & Co., 19, St. Helen's Place	British Honduras, Gulf of Mexico, Nicara- gua, and West Coast of Africa	Metals, hardware, arms, and general merchan- dise
Vicker, Sons & Co., (Lim.), 67, Palmers- ton Buildings	America, Russia, &c	Steels
Vivian & Sons, 3, Bond Court, Walbrook	China, India, Australia, Africa, and various	Yellow metal and copper
Vivian, Younger & Bond, 117, Basinghall Street	Sundry	Metals
Von Dadelszen & North, 4. East India Avenue	Various	Metals
Walker, Andrew G., 10, Laurence Pountney Lane	China and Japan	Metals and general merchandise
Wallace Brothers, 8, Austin Friars	East Indies	Metals, &c.
Ward, Richard, 1, New Broad Street	Italy	Machinery
Wardrop, Robert, 84, Lombard Street	Spain	Hardware, &c.
Warner, John, & Sons, 8, Jewin Court	Continent and Colonies	Bells, &c.
Warner, Walduck & Co., 11, Old Jewry Chambers	Hong Kong and various	Metals
Warren, D. & T. G., 75, Old Broad Street	East Indies	Ironworks, hardware, machinery, &c.
Warrington Wire Iron Company (Lim.), 61, King William Street	Various	Manufactured iron of all descriptions
Warrington Wire Rope Works (Lim.), 7, Great Winchester Street Buildings	Various	Wire ropes

Warehousemen and Shippers.	Ports.	Manufactures.	
Watt, Jas., & Co., 18, London Street	Various	General machinery	
Wattenbach, Hulger, & Co., 22, Great St. Helen's	East Indies and various	Manchester goods and metals	
Waydelin, C., 148, Fen-	Continent and various .	Iron and general	
Wedlake, M. & C., 118, Fenchurch Street	Colonies, &c	Agricultural machinery	
Wheeler & Wilson, Manufacturing Com- pany, 139, Regent Street; and 43, St.	All over the world .	Sewing machines	
Paul's Church Yard Whetham & Sons, 39A, Gracechurch Street	America and India .	Machinery, &c.	
Whight & Mann, 143, Holborn Bars	Australia, New Zealand, East Indies, and China	Sewing machines	
White, Child & Co., 22, College Hill	Continent	Machinery and general merchandise	
Whitfield, George, & Co., 17, Gracechurch Street	West Indies, South America, and various	Hardware, &c.	
Whitmore & Bunyon, 28, Mark Lane	Various	Machinery	
Whitwell, Wm., & Co., 26, Lombard Street	Continent and various .	Pig iron, bars, rails, &c.	
Whyte, Robert, 21, Duke Street, Aldgate	Cape	Hardware and general	
Wilkinson, Barkworth & Co., 16, Austin Friars	West Indies and various	Hardware and general merchandise	
Wilcox & Gibbs, 135, Regent Street; and 150, Cheapside	Various	Sewing machines	
Williams, Foster & Co., 27, Clement's Lane	Various	Copper and other metals	
William, Harvey & Co., 216, Upper Thames Street	Various	Block and bar tin	
William Brothers, 42, Cannon Street	Africa, South America, and various	Rifle guns and pistols, revolving and breech- loading fire arms	
Williamson, Geo., & Co., 2, East India	India	Hardware and tin pails	
Wilson, Calder & Co., 30, Albert Buildings,	Australia, East and West Indies, and	Machinery, &c.	
Queen Victoria Street Wilson, Swale & Co., 147, Leadenhall Street	various Mauritius	Hardware and general	
Wippermann, Gustave, 19, Water Lane	Various	Metals	

Warehousemen and Shippers.	Ports.	Manufactures.
Wood, W. A., 77, Upper Thames Street	Australia, New Zealand, Cape, Continent, and various	Mowing and reaping ma- chines
Woodman, T. H., & Co., 34, High Street, Borough	Various	Agricultural machinery
Wright, A., & Co., 16, Little Alie Street, Whitechapel	New Zealand, Australia, and Colonies	Smiths' and house bellows and portable iron forges
Wyche, C., 3 and 4, Skinner's Place, Size Lane		Manchester goods, hard- ware, saddlery, &c.
1	Wast Indies.	Machinery and metals

Read "Important Hints to Iron Masters and Marchana," at page [16], which have reference to the whole List of Dayon and Simpson.

## LIST

OF ALL THE

## BLAST FURNACES IN THE UNITED KINGDOM.

SHOWING ALL NOW IN BLAST AND THOSE STANDING IDLE, WITH THE NAMES OF THE WORKS AND THEIR PROPRIETORS.

Name of Works and Owners.	Built.	In Blast.	Kinds and Quality of Iron made.
SOUTH STAFFORDSHIRE & EAST WORCESTERSHIRE.			
WOLVERHAMPTON.			
Chillington—Chillington Iron Co.	6	4	Good grey forge
Parkfield—Parkfield Iron Co.	5	31	Good cinder forge
Millfields—J. T. Sparrow & Co.	4	02	Did make good iron
Priestfields, New-W. Ward and Sons.	2	1	Very strong grey forge
Osier Bed-Osier Bed Iron Co.	4	1	Good grey forge
Stow Heath—W. and J. S. Sparrow.	3	11	
Willenhall — Fletcher, Solly, and Urwick.	3	234	Strong grey forge
BILSTON.			
Bilston Brook—Bilston Brook Furnace Co.	3	2	Cinder melters and cinder forge
Herbert's Park—D. Jones and Sons.	1	1	Good forge
Barbor's Field—Fowler, Hol- croft and Hughes	2	11/2	First-class grey forge
Caponfield — J. Bagnall and Sons.	3	2	First-class grey forge
Spring Vale-A. Hickman .	3	23	

Name of Works and Owners.	Built.	In Blast.	Kind and Quality of Iron made.
BILSTON—cont.			
Deepfields—Deepfields Iron Co.	3	2	Cinder forge and melter
Coseley-J. and T. Turley .	2	13	
Priorfields—H. B. Whitehouse	3	3	Best melters
Stonefield—Stonefield Iron Co.	1	1	Cinder grey forge
Bradley—G. B. Thorneycroft and Co.	2	2	First-class grey forge
Bouvereux-Holcroft and Co	2	1	Good mine iron
WEDNESBURY.			
Rough Hay — Addenbrooke, Smith, and Pidcock.	3	2	First-class grey forge
Old Park—Patent Shaft and Axletree Co.	3	2	Very good grey
Broadwaters—S. Groncutt and Sons.	3	2	Grey forge, various
Darlaston—Darlaston Iron and Steel Co.	3	21/2	Good grey forge
Moxley—David Rose	2	1	Good forge iron
TIPTON.			
Wednesbury Oak—P. Williams and Sons.	3	2	First-class cold blast mine iron
Willingsworth Iron Co.— Messrs. Pearson and Kendrick	2	2	Good forge iron
Tipton—J. and T. Turley .	2	0	No return
Tipton Green—W. Roberts and	4	33	
	3	3	Best in district
Coneygree—Earl of Dudley . Park Lane—J. Colbourn and Sons.	2	2	Good mine forge
Horseley—J. Colbourn and Sons	2	2	Good mine forge
Groveland—G. Hickman	2	2	Cinder forge
Hange Tividale—Round Bros.	2	2	First-class mine forge
Dudley Port—George Vernon	3	0	Cinder forge and melters
Do. J. and C. Onions.	1	1	Cinder forge and melters
WEST BROMWICH AND OLDBURY.			Metters
Gold's Hill—J. Bagnall and Sons.	3	1	First-class mine

Name of Works and Owners.	Built.	In Blast.	Kind and Quality of Iron made.
WEST BROMWICH AND OLDBURY—cont.			4.0
Union-P. Williams and Co	3	11	First-class mine
Stour Valley-J. and C. Onions	2	2	Cinder melters and forge
Crookhay—H. and O. Firmstone.	4	2	Forge iron
Cape Smethwick	1	0	
Walsall.			
Roughwood-Williams Bros	2	0	
Hatherton—G. & R. Thomas .	2	12/3	Make good mine iron
Birchills, New — J. Brayford (dead).	4	0	
Bentley-Chillington Iron Co.	2	2	Good mine
Pelsall—B. Bloomer and Son .	2	2	Good mine
Green Lanes—Jno. Jones and Sons., Walsall Iron Co.	2	14	
Dixon's Green—Walsall Iron Co.	1	1	Cinder
Oldbury—J. & S. Onions .	4	0	
WEST OF DUDLEY.			
Corngreaves—New British Iron	6	4	First-class quality
Withymoor—W. H. Dawes .	2	2	Very good mine.  Make best hydrate iron
Netherton — N. Hingley and Sons.	4	3	Good iron
Windmill End—J. H. Pearson, Sir H. St. Paul	3	2	Good melter
New Level-Earl of Dudley .	4	3	The very best pigs
Netherton, New—M. and W. Grazebrook.	2	2	Quite the best cold blast pigs, made for sale. A noted speciality
Woodside-Cochrane and Co	3	23	
Old Level—Hall, Holcroft and Pearson, Henry Hall	3	24	Good forge iron
Shutt End-J. Bradley and Co.	4	3	High-class forge
Corbyn's Hall, New-Corbyn's	4		Forge iron, good
Hall Iron Co.	1	1	","

Name of Works and Owners.	Built.	In Blast.	Kinds and Quality of Iron made.
WEST OF DUDLEY-cont.			
Corbyn's Hall—Executors of W. Matthews.	4	2	Good mine forge
The Leys—W. and G. Firm-stone	3	2	Strong mine forge
Parkhead—Evers and Martin .	2	2	Very good mine forge
Old Hill-David Rose	2	1	Good mine forge
Buffery-Jno. Jones and Sons.	1	1	Forge iron
Total	171	110	
NORTH STAFFORDSHIRE.			
Biddulph Valley — Robert Heath and Son	4	$3\frac{1}{2}$	Best mine forge
Norton-Robert Heath and Son	4	4	Strong mine forge
Clough Hall-Kinnersly and Co.	4	4	Good mine forge
Fenton Park — Fenton Park Iron Co.	2	0	Mine forge
Goldendale—Williamson Bro- thers	4	3	Good mine forge
Lane End—Thomas Goddard and Son	3	3	No. 3 and 4 melters
Shelton—Earl Granville.	8	7	Good mine forge
Silverdale—Stanier and Co.		- 1	∫ Good mine forge
Apedale—Stanier and Co.	8	$5\frac{1}{2}$	Good mine forge
Talke—New North Stafford- shire Iron Co.	2	11/2	
	-		
Total	39	311	

### Messrs. Goddard are about to erect one new furnace at Lane End.

Name of Works and Owners.	Built.	In Blast.	Kinds and Quality of Iron made.
DERBYSHIRE.			
Alfreton-J. Oakes and Co	3	21	Grey forge
Butterley Co. Codnor	7	5	Grey forge
Clay Cross—The Clay Cross Co.	3	2	Grey forge
Denby-W. H. & George Dawes	4	3	Grey forge

Name of Works and Owners.	Built.	In Blast.	Kinds and Quality of Iron made.
DERBYSHIRE—cont.			
Morley Park—C. C. Disney . Newbold—Newbold Iron Co Oakerthorpe — Oakerthorpe	1 2	$\begin{bmatrix} 1\frac{1}{2} \\ 1 \\ 0 \end{bmatrix}$	Grey forge Grey forge Grey forge
Iron and Coal Co., Limited Renishaw—Appleby and Co Sheepbridge — Sheepbridge	4 5	2 5	Grey forge Grey forge
Coal and Iron Co., Limited Stanton—The Stanton Iron	5	5	Grey forge good
Works Co. Staveley—Staveley Iron and	7	61	
Coal Co., Limited West Hallam—H. B. White-	3	2	melters Grey forge very
house & Sons Wingerworth — Wingerworth	3	3	good Grey forge good
Iron Co.	_	_	and, mage good
Total	49	38	
SHROPSHIRE.			
Dark Lane Hinkshay fell Castle Lawley Co	$\begin{cases} 4 \\ \begin{cases} 2 \\ 1 \\ 2 \\ 1 \end{cases} \end{cases}$	3 1 0 2 1	Grey forge Best grey forge very
$ \begin{array}{c} \textbf{Lodge Wood} \\ \textbf{Prior's Lee} \end{array} \right\} \begin{array}{c} \textbf{Lilleshall} & \textbf{Iron} \\ \textbf{Co.} \end{array} $	}9	8	good { Very best grey forge and melters
Madeley Wood—Madeley Wood Co.	3	3	Highest class grey forge and melters
Madeley Court—W. O. Foster	3	2	First-class grey forge
Old Park—Old Park Iron Co.	4	2	Grey forge
Total	29	22	
YORKSHIRE—WEST RIDING.			
Beeston Manor—A. Harding and Co.	2	1	First-class forge
Bowling—Bowling Iron Co	6	5	Highest class mel- ters. Grey forge

Name of Works and Owners.	Built.	In Blast.	Kinds and Quality of Iron made.
YORKSHIRE—WEST RIDING —cont.			
Elsecar—W. H. and George Dawes.	4	2	Good grey forge and melters
Milton—W. H. and George Dawes.	2	2	Good grey forge
Farnley—The Farnley Iron Co.	4	2	High class grey forge
Holmes-Parkgate Iron Co.,	5	5	Good grey forge
Lim. and Parkgate			
Low Moor, Bradford—Hird, Dawson, and Hardy.	8	6	Highest class. Most valued iron in the kingdom
Thorncliffe, Chapeltown—Newton, Chambers, and Co.	2	1	Grey forge
Worsborough — Worsborough	1	0	
Iron Co. New York, Leeds—R. and W.	2	2	Good iron
Garside's Trustees. Hepworth—Hepworth Iron Co.	9	0	
Brightside—Cooke and Co	2 2	2	Good grey forge
West Ardsley—West York-	5	4	Good grey forge
shire Iron and Coal Co.		T	Good giely longe
Total	45	32	
NORTH-WEST OF ENGLAND.			
Duddon—Harrison Ainslie and	1	1	Charcoal
Lonsdale Iron Co	2	1	Bessemer iron
Moss Bay—Hematite Iron Co.	2	1	Bessemer iron
Wigan—Wigan Coal and Iron Co., Lim.	10	9	Good semi-hematite
Ditton—Ditton Brook Iron Co.,	6	4	Good hematite forge
Carnforth—Carnforth Hema- tite Iron Co., Lim.	5	5	Good hematite forge
Barrow—Barrow Hematite Steel Co., Lim	14	12	Noted Bessemer and strongest hema- tite grey forge and melting iron <sup>1</sup>
Cleator—Whitehaven Hematite Iron Co.	6	5	Gray Bessemer iron

<sup>&</sup>lt;sup>1</sup> The very best No. 1 and 2 likewise made here.

Name of Works and Owners.	Built.	In Blast.	Kinds and Quality of Iron made.
NORTH-WEST OF ENGLAND —cont.			
Harrington—Bain, Blair, and Paterson	4	4	Good hematite forge iron and Bessemer
Workington—Workington Iron Co.	6	41	High class Bessemer
West Cumberland—Hematite Iron Co., Lim.	5	4	Bessemer iron
Millom—Cumberland Iron Min- ing and Smelting Co., Lim.	6	5	Best Bessemer iron
Askam—Furness Iron and Steel Co., Lim.	3	$\frac{23}{4}$	Bessemer iron
Maryport-Gilmour and Co.	6	6	Bessemer iron
Solway-Solway Iron Co.	4	3	Bessemer iron
Furness—Furness Iron Co	2	0	
Total	82	67	

The Moss Bay Hæmatite Iron Co. are building two furnaces. The Ditton Iron Co. are building two furnaces.

Blair and Co. are building two new furnaces at Pacton,

New North of England Iron Co. are building two new furnaces at Workington.

The Maryport Hæmatite Iron Co. are building one new furnace. The Barrow Rolling Mills Co. are building two new furnaces. The Lonsdale Iron Co. are building two new furnaces.

Name of Works and Owners.	Built.	In Blast.	Kinds and Quality of Iron made.
CLEVELAND.			
MIDDLESBOROUGH.			
Lackenby—Lackenby Iron Co.	3	2	Grey forge and
Eston — Bolckow, Vaughan, and Co.	7	7	Grey forge and melters
South Bank—T. Vaughan and Co.	9	$7\frac{1}{2}$	No. 1 and grey forge
Clay Lane—T. Vaughan and Co.	6	6	No. 1 and grey forge
Cargo Fleet—Swan, Coates, and Co.	4	4	Forge and melters
Normanby—Jones, Dunning, and Co.	3	3	Grey forge

Name of Works and Owners.	Built.	In Blast.	Kinds and Quality of Iron made.
MIDDLESBOROUGH—cont.			
Ormesby-Cochrane, and Co	4	3	Grey forge
Tees—Gilkes, Wilson, Pease, and Co.	5	434	
Middlesborough — Bolckow, Vaughan, and Co.	3	3	Grey forge
Tees Side—Hopkins, Gilkes, and Co.	4	4	No. 1 and grey forge
Linthorpe—Lloyd and Co	6	6	No. 1 and No. 3
Acklam—Stevenson, Jaques,	4	4	Grey forge
and Co.	*	-	Grey lorge
Ayresome—Gjers, Mills, and	4	4	No. 1 and No. 3
Newport—B. Samuelson and Co.	8	71/2	Grey forge
Clarence—Bell Brothers	8	8	Grey forge
Felling Gateshead—H. L. Pattinson and Co.	2	• 0	,
STOCKTON-ON-TEES.			
Norton—Norton Iron Co	6	3	Best Bessemer and grey forge good
Norwegian-Titanic Iron Co.	2	2	Grey forge good
Thornaby—W. Whitwell and Co.	5	3	Grey forge
Stockton-Stockton Iron Co	3	3	Grey forge
Carlton—Industrial Iron Co	3	2	Grey forge
WHITBY.			
Grosmont—C. and T. Bagnall,	2	2	Good grey forge and melters
Glaisdale—S. Cleveland Iron	3	3	No. 1 and No. 3
Total	104	- 913	
NORTH-EAST OF ENGLAND.		-4	
DARLINGTON.			
	3	3	Melters
Middleton—Geo. Wythes and Co.			
South Durham—South Durham Iron Co.	3	3	Grey forge

Name of Works and Owners.	Built.	In Blast.	Kinds and Quality of Iron made.
FERRY HILL.			
Ferry Hill—Rosedale and Ferry Hill Iron Co.	8	8	No. 1 and good grey forge
Hareshaw—Hareshaw Iron Co.	2	0	
BISHOP AUCKLAND.			
Witton Park — Bolckow, Vaughan, and Co.	5	5	Grey forge
Tow Law—Weardale Iron Co.	4	3	Best in district made here. Bessemer iron
Consett.			
Consett—Consett Iron Co	12	6	Grey forge good
CHESTER-LE-STREET.			
Birtley—Birtley Iron Co	3	0	
Washington.			
Wear—Bell Brothers	1	1	No. 1 and No. 3 and
LEAMINGTON-ON-TYNE.			grey forge
Leamington-on-Tyne—Bulmer and Co.	2	0	
Newcastle-on-Tyne.			
Jarrow—Palmer's Shipbuilding and Iron Co.	4	4	Grey forge
Elswick—Sir Walter G. Armstrong and Co.	2	2	Melters good
Walker—Losh, Wilson, and Bell	2	2	Melters
Seaham—Watson, Kipling and	1	1	Best Bessemer
Wylam—Bell Brothers	1	0	
Total	53	38	

The Rosedale and Ferry Hill Co. are building two furnaces. Bolckow, Vaughan, and Co. are building one new furnace at Eston.

Whitwell and Co. are building two new furnaces.

Downey and Co. are building two new furnaces at Coatham Iron Works.

Teesbridge Co. are building two new furnaces.

Robson, Maynard, and Co. are building two new furnaces at Redcar.

T. Richardson and Co. are building three new furnaces at West Hartlepool.

Messrs. Watson, Kipling, and Co. are building one new furnace.

Messrs. Hopkins, Gilkes, and Co. are building three new furnaces.

The Lackenby Iron Co. are building one new furnace.

Cochrane and Co. are building two new furnaces.

Gjers, Mills, and Co. are building one new furnace.

B. Samuelson and Co. are building one new furnace.

Consett Iron Co., Limited, are building two new furnaces.

North of England Iron Co. are building one new furnace.

Name of Works and Owners.	Built.	In Blast.	Kinds and Quality of Iron made.
GLOUCESTERSHIRE.			
Cinderford—Henry Crawshay & Co.	4	3	Best grey forge
Oakwood-Ebbw Vale Iron Co.	1	0	Grey forge
Park End, Lydney—Forest of Dean Iron Co.	3	2	Best grey forge
Soudley, Newnham — Goold Brothers	2	, 1	Best grey forge
WILTSHIRE.			
Westbury—Westbury Iron Co.,	4	3	Grey forge
Seend—Malcolm and Co	3	2	Grey forge
SOMERSETSHIRE.			
Ashton Vale—Ashton Vale Iron Co., Limited	1	1	Good grey forge
HAMPSHIRE.			
Warsash—Harrison Ainslie and Co.	1	0	
Total, Gloucestershire,	-	-	
Wiltshire, Somerset- shire and Hampshire	19	12	

Name of Works and Owners,	Built.	In Blast.	Kinds and Quality of Iron made.
NORTHAMPTON AND LIN- COLNSHIRE.			
East Endand Frithlingborough, Wellingborough—T. Butlin and Co.	4	4	Grey forge good
Heyford, Weedon-Geo. Pell .	3	2	Grey forge good
Stowe, Weedon—Castle Dyke's Co.	2	0	Made but very little
Finedon, Northampton—Glen- don Iron Co., Checkland and Fisher	3	3	Grey forge
Trent (North Lincoln)—W. H. and G. Dawes	3	2	Grey forge
Frodingham — Frodingham Iron Co.	4	$3\frac{3}{4}$	Grey forge
North Lincolnshire — North Lincolnshire Iron Co.	2	1	Grey forge
Islip—Thrapstone C. H. Plevins	1	0	
Total	22	153	

The Frodingham Iron Co. are building a new furnace. The Lancaster Iron Co. are building two new furnaces at Mostyn.

Name of Works and Owners.	Built.	In Blast.	Kinds and Quality of Iron made.
NORTH WALES.			
Brymbo—Brymbo Iron Co	3	2	Grey forge very
Ffrwd—Sparrow and Poole .	3	13	
Leeswood—Leeswood Iron Co.,	2	1	Grey forge
Plaskynaston—Buckley, New- ton, and Co.	1	0	
Ruabon—New British Iron Co.	3	1	Grey forge very good
Mostyn—John Lancaster and Co.	2	2	Bessemer
Total North Wales .	14	73	

Name of Works and Owners.	Built.	In Blast.	Kinds and Quality of Iron made.
MONMOUTHSHIRE AND SOUTH WALES.			
Abersychan—Ebbw Vale Co	6	2	Grey forge
Ebbw Vale— Ditto	3	2	Grey forge
Victoria- Ditto	3	2	Grey forge
Sirhowey Ditto	4	4	Grey forge
Pontypool— Ditto	3	3	Best grey forge
Nant-y-Glo-J. & C. Bailey .	6	6	Grey forge
Blaenavon-Blaenavon Iron Co.	10	8	Best grey forge
Beaufort	6	6	Grey forge
Blaina-Levick and Co	2	0	Grey forge
Cwm Celyn- Ditto	3	2	Grey forge
Coalbrook Vale—Ditto	1	1	Grey forge
Cwm Brân—Patent Nut and Bolt Co.	2	2	Best grey forge
Rhymney 6, Bute 3—Rhymney Co.	9	7	Best grey forge
Tredegar—Tredegar Iron Co	9	7	Grey forge
Total	67	52	-
GLAMORGAN.			
Aberaman—Powell Duffryn .	3	3	Grey forge
Abernant 2, Llwydcoed 3—	5	3	Grey forge
Fothergill and Co.	"		diej loige
Plymouth 3, Duffryn 4-	10	4	Grey forge
Fothergill and Co.	7	0	Gray farms
Penydarran—FothergillandCo.	í	0	Grey forge
Brynna—Fothergill and Co Briton Ferry — Townsend,	2	2	Grey forge
Wood, and Co.	-		Grey forge
Cwn Avon—Copper Miners .	6	31/2	Good grey forge
Cyfarthfa 5, Ynisvach 4—R. T.	11	92	Grey forge
Crawshay, Ynisfach			diej ioigo
Cefn Cwsk—Mr. Talbot .	4	0	Grey forge
Dowlais—Guest and Co	17	16	Grey forge
Gadlys—Wayne and Co	4	2	Grey forge
Llynvi—Llynvi Iron Co	7	4	Good grey forge
Maesteg—Maesteg Iron Co	3	0	Grey forge
Pentyrch—Booker and Co	2	2	Grey forge
Pontardawe—Lewis and Sons.	1	o	Grey forge
Pontypridd—Francis Crawshay		ŏ	arey lorge
Tondu—Brogden and Sons .	2	2	Good grey forge
_ Loude Diogeon and Dons .	3	ő	Good groj loige

Name of Works and Owners.	Built.	Jn Blast.	Kinds and Quality of Iron made.
GLAMORGAN—cont.			
Ystalyfera <sup>1</sup> —Budd and Co Venalt <sup>1</sup> —W. Gregory	11	6	Grey forge Grey forge
Total	102	$\frac{-}{56\frac{1}{2}}$	arey rorgo
Brecon.			
Yniscedwyn 1 — Yniscedwyn Iron Co.	2	2	First-class forge and melting
Onllwyn, Neath — Onllwyn Iron Co.	2	0	Grey forge
Hirwain—Hirwain Iron Co Beaufort—J. and C. Bailey .	4 7	0	Grey forge Grey forge
Clydach—Basil Jayne	4	0	Grey forge
Total	19	8	
CARMARTHENSHIRE.			
Bryn Amman 1—Strick and Co. Gwendreath—D. Watney Trimsaran (Gwendreath)—	3 3 2	3 0 0	Good grey forge Grey forge Grey forge
Pembroke.			
Kilgetty <sup>1</sup> —Vickerman and Co.	2	0	
Total	10	3	

FURNACE BUILDING.

The Blaenavon Company are building one new furnace.

Name of Works and Owners.	Built.	In Blast.	Kinds and Quality of Iron made.
SCOTLAND.			
Gartsherrie — Messrs. Wm. Baird and Co.	16	12	No. 1 melting
Coltness-Coltness Iron Co	12	12	No. 1 melting
Summerlee-Wilson and Co	8	7	No. 1 melting
Langloan-Robert Addie .	8	7	No. 1 melting
Govan-W. Dixon	5	5	No. 1 melting and No. 3

<sup>1</sup> Use anthracite coal.

Name of Works and Owners.	Built.	In Blast.	Kind and Quality of Iron made.
SCOTLAND—cont.			
Calder-W. Dixon	8	6	No. 1 melting
Carnbroe—Merry and Cuning- hame.	6	6	No. 1 and No. 3
Shotts—Shotts Iron Co	4	4	No. 1 melting
Castle Hill—Shotts Iron Co	3	3	No. 1 melting
Wishaw-Wishaw Iron Co	3	2	No. 1 and No. 3
Calderbank — Monkland Iron and Steel Co.	6	5	No. 1 and No. 3
Chappelhall — Monkland Iron and Steel Co.	3	3	No. 1 and No. 3
Clyde-Colin, Dunlop, and Co.	6	5	No. 1 and No. 3
Clyde (Quarter) Colin, Dunlop, and Co.	4	4	No. 1 and No. 3
EAST COAST.			
Kinneil—George Wilson and Co.	4	3	No. 1 and No. 3
Almond—James Russeland Son	3	2	No. 1 and No. 3
Carron—Carron Iron Co	4	3	No. 1
Lochgelly—Lochgelly Iron Co.	4	2	No. 1 and No. 3
Lumphinans — Lumphinans Iron Co.	2	1	No. 1 and No. 3
Bridgeness—Henry Cadell .	2	1	No. 1 and No. 3
WEST COAST.			
Eglinton-W. Baird and Co	7	7	No. 1 and No. 3
Lugar— Ditto	4	4	No. 1 and No. 3
Muirkirk— Ditto	3	3	No. 1 and No. 3
Portland— Ditto	6	4	No. 1 and No. 3
Dalmellington—Dalmellington Iron Co.	8	7	No. 1
Glengarnock — Glengarnock Iron Co.	9	71/2	No. 1
Ardeer—Merry and Cunning- ham	5	4	
HADDINGTONSHIRE.			
Glaselsmuir — Westbank, C. and A. Christie	1	1	
Lorn—Harrison, Ainsley, and	1	10	
Total	155	1301	

#### ABSTRACT OF TABULAR STATEMENTS.

#### BLAST FURNACES.

Name of Works and Owners.	_	Built.	In Blast.	Kinds and Quality of Iron made.
Cleveland		104 53 82 171 39 29 45 49 22 19 14 198 155	$\begin{array}{c} -1\frac{3}{4}\\ 38\\ 67\\ 110\\ 31\frac{1}{2}\\ 22\\ 32\\ 38\\ 15\frac{3}{4}\\ 12\\ 7\frac{3}{4}\\ 119\frac{1}{2}\\ 130\frac{1}{2}\\ -\end{array}$	qualities are so varied in most districts, that it is difficult with accuracy to describe them. We may, however, say that the best iron is made near Bradford in Yorkshire, Staffordshire, Shrop-
Total		980	$715\frac{3}{4}$	

#### CHARCOAL FURNACES.

Newland furnace, converting into hot blast-charcoal-		
Harrison, Ainslie, and Co	1	0
Backbarrow furnace, cold blast - charcoal-Harrison,		
Ainslie, and Co	1	1
Duddon furnace, cold blast — charcoal — Harrison,		
Ainslie, and Co. (Cumberland)	1	0
Bonaire furnace, cold blast — charcoal — Harrison,		
Ainslie, and Co. (Lorn, Argyleshire)	1	1
Bonaire furnace, cold blast-charcoal (Bilston, Stafford-		
shire)	2	<b>2</b>
Warsash furnace, cold blast-charcoal-Harrison, Ainslie,		
and Co. (Hampshire)	1	1

# LIST OF ALL THE PUDDLING FURNACES IN THE UNITED KINGDOM.

\*\* So many changes are continually being made by the introduction of Danks's, Casson's, and other Fatent Furnaces, and such large numbers of Puddling Furnaces are standing from one cause or other, that it is quite impossible to make this List of Puddling Furnaces as perfect as we could wish.

#### SOUTH STAFFORDSHIRE.—BLACK COUNTRY.

BILSTON.	Number of Proddling Furnaces.	Number of Mills and Forges.
Bank Field Bradley S. Groucutt and Son.	. 45	8
Batman's Hill-W. Rose	. 11	3
Bilston Mill-W. and J. S. Sparrow .	. 26	4
Bradley Tin Plate-Thompson, Hatton, an	d	
Co	. 8	4
Bradley-Stephen Thompson	. 9	2
Bradley, New-Gittings and Austin .	. 8	1
Deepfields—Bilston Iron Co	. 12	1
Bilston Bridge and Herbert's Park-Davi	id	
Jones and Sons	. 29	4
Millfield—Standing	. 14	1
Britannia—Brereton and Co	. 11	3
Regent—Regent Iron Co	. 11	3
Stonefield—Bilston Iron Co	. 20	5
Ettingshall-Morewood and Co	. 12	3
Ebenezer-Standing, H. Onions and Co.	. 10	1
Millfields, New-Adams and Co	. 12	4
WOLVERHAMPTON DISTRICT.		
Lanesfield—Brookes and Merriman .	. 19	3
Chillington, Capponfield, Bilston, Leebrook,  Chillington Iron Co	95	6
Cleveland, Monmoor-E. T. Wright .	. 25	81
Horseley Fields-Osier Bed Iron Co	. 26	6
Minerva-Isaac Jenks and Sons	. 21	4
Shrubbery, Swan Gardens-G. B. Thorne	y-	
croft and Co	. 74	12

WILLENHALL.	Number of Puddling Furnaces.	Number of Mills and Forges.
Monmoor Lane-H. Deakin	15	3
WEDNESBURY DISTRICT.		
Bull's Bridge—Molineux and Co	10	2
Darlaston Green—Darlaston Iron and Steel Co., Lim.		4
King's Hill—Darlaston Iron and Steel Co., Lim.	42	8
Victoria, Moxley-David Rose	8	1
Albert, Moxley—David Rose	22	3
Monway—J. Marshall	10	3
Old Park-Patent Shaft and Axle Co	32]	0
Brunswick- Ditto ditto	54	8
Moxley—Thomas Wells	22	3
W D		•
WALSALL DISTRICT.		
Pleck Walsall—Skelton and Yardley	18	<b>2</b>
Victoria—H. Mills and Sons	10	2
Wedge's Mills, Cannock—W. Gilpin, sen., and		
Co	8	2
Birchills—J. Bissell and Son	16	3
New Birchills—Birchills Hall Iron Co., Lim	12	2
Staffordshire—Bunch, Jones, and Co	10	2
Pelsall—B. Bloomer and Son	40	7
Cyclops—E. Russell	22	3
WEST BROMWICH DISTRICT.		
Gold's Hill Imperial John Bagnall and Sons	75	8
Gold's Hill, New-T. Davis	13	2
Albion-Albion Sheet Iron Co	10	2
Atlas-E. Parkes	15	3
Brick House-R. Williams and Son	8	2
Bromford-J. Dawes and Sons	69	7
Hall End-J. T. and W. E. Johnson	9	1
Crookhay-W. and G. Firmstone	20	3
Witton's Lane-Roberts, Tonks, and Co	5	1
Excelsior-T. P. Allen and Co	12	2

West Bromwich—cont.	Number of Puddling Furnaces.	Number of Mills and Forges.
Eagle—Eagle Coal and Iron Co	20	3
Great Bridge-Iron and Steel Co	10	2
Victoria, Swan Village-D. Hipkins and Sons	8	1
Ridgacre-Whitehouse Brothers and Co	20	2
Wellington-Allen and Holden	13	2
Roway—E. Page and Sons	16	2
Spon Lane-Patent Nut and Bolt Co	11	2
Providence-Bridge, Gill, and Bridge	16	2
Albion—Britannia Iron Co	10	2
Albion-Lees, J. B. S., and C	12	2
Dunkirk-Jordan and Co	4	1
Waterloo-J. T. and W. E. Johnson	23	3
Bush Farm—Bush Farm Iron Co	18	2
Bradford—Bradford Iron Co	9	1
Richmond Works-Maddock's and Downing .	8	1
Bromford—John Dawes & Son	69	$\begin{cases} 7 \\ 2 \end{cases}$
SMETHWICK.	*	
Gun Barrel—W. Marshall	4	1
Anchor—Standing	7	1
Smethwick—J. Stone	3	1
Capetown—W. H. Brooks	5	2 .
Crown—J. Nicklin	11	3
London Works-London Works Co	12	2
Grove-Nash and Co	10	1
District—District Iron Co	20	3
Rabone Bridge—Rabone Bridge Iron Co	10	2
Vulcan—Standing	8	1
Regent—Beard and Eberhard	11	3
Oldbury.		
Brades—Hunt and Sons	12	3
Britannia—Bright, Perry, and Gettings	13	2
Eagle—F. Simpson and Co	10	1
TIPTON.		
Bloomfield		
Factory W. Barrows and Son	100	10
Tipton Green J		

TIPTON—cont.	Number of Puddling Furnaces.	Number of Mills and Forges,
Globe and Tividale-J. P. Haynes	. 9	2
Groveland—G. Hickman	. 24	3
Great Bridge—Great Bridge Iron and Steel Co		
Lim	. 20	2
Gospel Oak Iron Co	. 24	5
Sheepwash Lane-Stonehewer and Co	. 16	2
Summer Hill-W. Millington and Co	. 16	4 /
Church Lane-District Steel and Iron Co.	. 10	2
Hope Iron Co :	. 6	2
Toll End-E. and T. Bayley	. 7	2
Wednesbury Oak-P. Williams and Sons	. 32	5
Dudley Port	. 8	1
Dudley.		
Portfield—James Holcroft	10	
Dudley Port—Plant and Fisher	. 18	3
	. 20	3
Netherton—Hingley and Sons	. 42	3
Dixon's Green—Dixon's Green Iron Co.	. 11	1
Corbyn's Hall	. 40	3
BRIERLEY HILL.		
Brockmore Tinplate—Budd and Co	. 88	3
Hart's Hill-Hingleys and Smith	. 33	3
Level—H. Hall	. 18	2
Round Oak-Earl of Dudley	. 54	5
Brierley N. Brief T. G		_
Corngreaves New British Iron Co	. 64	8
The Lays—Brown and Freer	. 33	7
Cradley Forge—S. Evers and Sons .	. 18	3
Swindon-E. P. and W. Baldwin	. 12	2
Stourbridge.		
Brettel Lane ] m W 11		
Bretwell Hall T. Webb and Sons .	. 21	4
Stourbridge 7		
Brierley John Bradley and Co	. 64	8
Shutt End		-
Whittington-J. Williams and Co	. 9	2
Hyde-Lee and Bolton (2 Siemens Furnace		_
of monte home)	. 20	5

KIDDERMINSTEB.	Number of Puddling Furnaces.	Number of Mills and Forges.
Cookley—J. Knight and Co	18	2
Broadwaters-Thompson, Hatton, and Co	11	2
Wilden-E. P. and W. Baldwin	7	2
Total	2,160	
NORTH STAFFORDSHIRE.		
TUNSTALL DISTRICT.		
Ravensdale-Robert Heath and Son	56	
Chesterton-Chesterton Mining Co., Lim	28	3
BIDDULPH.	٠	
Biddulph—Robert Heath and Son	43	
NORTON-IN-THE-MOORS.		
Norton—Robert Heath and Son	44	
Kidsgrove.		
Clough Hall-Kinnersly and Co	81	7
Wheelock—Wheelock Iron and Salt Co	24	2
· STOKE-UPON-TRENT.		
Shelton-Shelton Bar Iron Company	97	7
Cliff Vale—J. Bull and Son	26	5
Berry Hill—W. Bowers	26	2
NEWCASTLE-UNDER-LYME.		
Silverdale-Stanier and Company	24)	_
Knutton— Ditto	33 }	5
· \		
Total	480	*
NORTH OF ENGLAND.		
MIDDLESBROUGH.		
Middlesbrough-Bolckow, Vaughan, and Co.,		
Lim.	67	11
Tees Side—Hopkins, Gilkes, and Co., Limited	100	5
a post contraction of the contra		•

${\tt Middlesborough} cont.$	Number of Puddling Furnaces.	Number of Mills and Forges.
Newport-Fox, Head, and Company	42	4
Imperial-Jackson, Gill, and Company, Limited	32	2
West Marsh-West Marsh Iron Company .	20	2
Britannia-Britannia Iron Company, Limited	120	3
Ayrton—Jones, Brothers, and Company .	23	2
STOCKTON.		
North Yorkshire—North Yorkshire Iron Com-	*0	
pany, Limited	59	4
Thornaby—W. Whitwell and Company	33	8
Richmond—R. Jaques and Company	6	1
Westbourne-J. Holdsworth and Company .	22	2
Malleable—Stockton Malleable Iron Company	58	5
Rail Mill—Stockton Rail Mill Company .	70	3
West Stockton—West Stockton Iron Company	33	3
Moor—Shaw, Johnson, and Reay	30	2
Bowesfield—Bowesfield Iron Company	30	2
Carlton-North of England Iron and Coal		
Company, Limited (Danks's Pat.)	8	2
DARLINGTON.		
Albert Hill Springfield —Darlington Iron Company, Lim.	198	8
Skerne-Skerne Iron Works Company, Lim.	58	4
Rise Carr-Fry, Ianson, and Company	32	4
Whessoe-Thomas Vaughan	36	2
FERRY HILL.		
Tudhoe-Weardale Iron and Coal Company,		
Lim	56	5
BISHOP AUCKLAND.		
Witton Park-Bolckow, Vaughan, and Co.,		
Limited	101	11
Bishop Auckland—Thomas Vaughan	30	2
Consett.		-
Consett—Consett Iron Company, Limited .	151	10
T	101	10

CHESTER-LE-STREET.	Number of Puddling Furnaces.	Number of Mills and Forges.
Birtley—Birtley Iron Company	6	1
Fence Houses.		
Britannia—Hopper, Radcliffe, and Company .	42	3
Sunderland.		
Monkwearmouth-S. Tyzack and Company .	32	2
Wear—Oswald and Company	80	4
South Hylton—Raine, Brothers	13	3
HARTLEPOOL.		
Hartlepool—Hartlepool Malleable Iron Co	32	2
West Hartlepool-T. Richardson and Sons .	109	3
Stranton—Stranton Iron and Steel Co., Lim.	20	2
NEWCASTLE-UPON-TYNE.		
Walker—Losh, Wilson, and Bell	57	4
JARROW-ON-TYNE.		
Jarrow-Palmer's Shipbuilding and Iron Com-		
pany, Limited	70	6
Hive—J. Elliot	13	1
GATESHEAD.		
Gateshead-Hawks, Crawshay, and Sons .	69	5
Park-J. Abbot and Company, Limited	38	2
Felling—Felling Coal and Iron Company, Lim.	23	2
Team—Thomas Abbot	20	2
	-	
Total	2,018	
NORTH WALES.		
RUABON.		
Broughton Hall-Broughton Iron Company .	12	2
Llay—Standing	. 6	1
Ruabon—New British Iron Company	38	3
Wrexham Stansty Forge	6	1
Pontysyllta	10	1
m. 1.3	PO .	
Total	72	

#### SOUTH WALES AND MONMOUTHSHIRE.

Llanelly.	Number of Puddling Furnaces.	Number of Mills and Forges.
Amman—Amman Iron Company	8	1
Cardiff.		
Aberdare and Abernant—Fothergill and Han-		
key	69	4
Aberamman—Standing	17	
Pentyrch and Merlin Griffith—T. W. Booker and Co.	14	2
4	19	2
Penydarren—Fothergill and Company		
Taff Vale—Standing	14	2
Treforest—J. Evans and Company	6	5
BRITON FERRY.		
Briton Ferry-Townsend, Wood, and Com-		
pany	42	4
ABERGAVENNY.		
New Clydach—Basil Jayne	12	1
PORT TALBOT.		
Cwm Avon and Taibach—Governor and Com-		
pany of Copper Miners	30	5
Bridgend.		
The STAR The STAR AND		
Llynvi Vale—Llynvi Tondu and Ogmore Company, Limited	54	6
MERTHYE TYDVIL.		
Cyfarthfa and Ynisfach—Robert T. Crawshay	72	4
Dowlais—Dowlais Iron Company	161	13
Gadlys—Gadlys Iron Company	23	2
Plymouth—Fothergill and Hankey	68	5
T 2	-	-

TONDU.

Tondu-Llynvi Tondu and Ogmore Company, Lim. included above

SWAN	SEA.		Number of Puddling Furnaces.	Number of Mills and Forges,
Ystalyfera—Budd and Company	7		42	16
New	PORT.			
Llanelly-Standing			10	1
Nantyglo-Nantyglo and Blaina	Company,	Lim.	66	5
Aberyschan—Ebbw Vale Iron C	ompany, L	im.	567	
$\left\{egin{array}{ll}  ext{Victoria} \  ext{Ebbw Vale} \end{array} ight\}$	ditto		165	9
Pontypool Ditto	ditto		16	
Blaina Nantyglo and	District L			
Company I		ron	52	4
Coalbrookdale		•	02	*
Blaenavon—Blaenavon Iron Con	apany .		89	8
Pontnewynydd— .			26	2
Varteg and Golynos-Partridge	and Jones		23	2
Rhymney—Rhymney Iron Com	pany .		93	108
Tredegar—Tredegar Iron Comp	any .		. 80	5
Oakfields-J. C. Hill and Compa			23	2
Cwm Bran—Patent Nut and Bo	lt Co		20	3
ABER	DARE.			
Hirwain-Standing	·		19	2
W-4-1			1.000	
Total .		•	1,306	
SHROP	SHIRE.			
COALBROOKDALE AND	OKENGAȚE	s D	ISTRICT.	
Horsehay-Coalbrookdale Co.			42	2
Stirchley-Leighton and Grenfe	u		30	4
Ketley-Ketley Iron Co			20	3
Trench-Shropshire Iron Co., L	im		24	3
Wombridge-Wombridge .			10	3
Hadley-Nettlefold and Chambe	rlain .		10	2

COALBROOKDALE AND OKENGATES DISTRICT—	cont.	Number of Puddling Furnaces.	Number of Mills and Forges,
Lawton-Bullivant and Co		10	1
Heybridge-Heybridge Co		10	1
Old Park-Old Park Iron Co., Lim. (standi	ing)	30	3
Snedshill—Snedshill Bar Iron Company		40	5
Hollinswood-Eagle Iron Company, Limite	be	16	. 3
5 1 77			
Total	•	232	
SOMERSETSHIRE.			
Bristol.			
Bower Ashton—Joseph Tinn		10	1
Bristol—George Tinn	•	3	1
Distoi—George Timi	•		
Total		13	
LANCASHIRE.	-		
MANCHESTER.			
Pendleton-W. Barningham		20	4
Ashbury—Ashbury Carriage and Iron Co.	•	17	2
Ashbury—Maybury, Matthews, and Co.	•	8	1
Wire Works—Richard Johnson and Nephe	ew.	20	3
Rail Mill—Manchester, Sheffield, and Linco		20	•
shire Railway Works		9	2
Staleybridge—John Summers		6	1
Parkbridge—Hannah Lees and Sons .		4	1
Oldham—Platt Brothers and Co		8	1
BOLTON.			
Bolton-Bolton Iron and Steel Co		6	5
Atlas Forge—Thomas Walmsley	•	16	2
Aulas Forge—Thomas Walmsley	•	10	_
WARRINGTON.			
Dallam-Dallam Forge Co., Lim		30	3
Bewsey-Wire Iron Co., Lim		43	6
•			

WARRINGTON—cont.	Number of Puddling Furnaces.	Number of Mills and Forges.
Whitecross Wire Works Wire Co.,	11	2
Ince Hall—Ince Hall Rolling Mills Co., Lim.	· 20	2
Preston.		
Preston—North of England Carriage and Iron Co., Limited	35	3
Wigan.		
Albion—Hall and Matthews	10	1
— Dallam Forge Co	31	2
LIVERPOOL.		
Mersey—Mersey Iron and Steel Co., Lim  Garston—Liverpool and Garston Iron and	4	2
Steel Co., Lim	46	3
Total	338	
NORTH-WEST OF ENGLAND	D.	
Workington.		
West Cumberland-W. Cumberland Iron and		
Steel Co., Lim	40	3
Kirk Brothers and Co	16	2
Moss Bay-Kirk and Valentine	11	2
Marsh Side Iron Works-Joseph Price, Jun.,		
and Co	6	2
MARYPORT.		
Ellen—Ellen Rolling Mills Co., Lim	12	3
Total	85	

<sup>&</sup>lt;sup>1</sup> Have six double puddling furnaces on Siemens' plan, reckoned twelve in return.

#### YORKSHIRE-WEST RIDING.

LEEDS.			Number of Puddling Furnaces.	Number of Mills and Forges.
Albert-W. T. Coghlan and Drury			24	3
Clarence-Taylor Brothers and Compar	n <b>y</b>		17	5
Farnley—Farnley Iron Co			24	4
Kirkstall Forge-Kirkstall Forge Co.			24	3
Leeds-S. T. Cooper and Co			13	6
Monk Bridge-Monk Bridge Iron Co.			26	8
Perseverance_J. Whitham and Son			40	4
Thornhill-Monk Bridge Iron Co.			12	3
Hunslet-Tyers, Middleton, and Co.			14	6
And 3 Bull furna	ces.			
BRADFORD.				
Bowling-Bowling Iron Co			32	6
Low Moor-Hird, Dawson, and Hardy			40	7
Water Lane—James Perkins .			40	4
WAKEFIELD.				
Calder Vale—Samuel Whitham .			30	4
Normanton.				
Railway Iron Works-W. Thomson an	d Co.		25	2
Total			358	
SOUTH YORKSHI	RE.			
SHEFFIELD.				
Atlas-John Brown and Co., Lim			72	17
Wortley—Andrews, Burrows, and Co.			11	4
Cyclops—C. Cammell and Co., Lim.			60	12
Elsecar and Milton—W. H. and George	Daw	es	61	10
And 6 Siemens' double				

<sup>&</sup>lt;sup>1</sup> Messrs. Whitham have 11 double machine puddling furnaces, equal to 36 hand furnaces.

ROTHERHAM.	Number of Puddling Furnaces.	Number of Mills and Forges.
Phœnix—Owens' Wheel and Tyre Co	26	2
Parkgate—Parkgate Iron Co., Lim	90	6
Midland-Midland Iron Co., Lim.	29	3
Northfield-Northfield Co., Lim	32	3
Rotherham—G. and J. Brown, Limited	27	3
Total	367	
DERBYSHIRE.		
Alfreton.		
Butterley—The Butterley Co	42	11
CHESTERFIELD.		
Whittington—T. Firth and Sons Sheepbridge—Sheepbridge Coal and Iron Co.,	18	3
Lim. <sup>1</sup>	27	2
DERBY.		
Railway-Eastwood, Swingler, and Company	14 )	3
Victoria—Eastwood, Swingler, and Company	25 \	o o
Total	126	
SCOTLAND.		
GLASGOW.		
	F0	
Blochairn—Hannay and Sons	50 47	4
Glasgow—Glasgow Iron Company St. Rollox— Ditto		6
Govan—William Dixon	13 40	2 5
Muirkirk—William Baird and Company .	12	2
Parkhead—W. and J. Beardmore	28	3

<sup>&</sup>lt;sup>1</sup> 9 double furnaces worked by mechanical power, and equal to 27 ordinary furnaces.

Coa	TBRID	GE.		Number of Puddling Furnaces.	Number of Mills and Forges,
Rochsolloch—Rochsolloch Iron	n Con	apan	у .	14	2
Clifton-Gray and Wyllie .		•		20	2
Coats—Thomas Jackson .				27	2
Wishaw-John Williams and	Comp	any		12	2
Drumpeller-Henderson and l				16	2
North British-Thomas Ellis				12	3
Phœnix-John Spencer				22	1
Globe-A. and T. Miller .				5	1
Coatbridge Tin Plate Wor	ks	Coat	bridge		
Tin Plate Co				11	2
Coatbridge Iron Works-Hugh	h Mar	tin a	nd Son	7	2
Monkland-Monkland Iron a					
pany, Limited				60	5
P					
Ho	LYTOW	ny.			
Mossend—Mossend Iron Comp		-		60	5
Clydesdale Iron Co			imited		2
Motherwell—Glasgow Iron Co	ompar	ıy		52	3
Dalziel—David Colville				15	2
Total .				565	
ABSTRACT LIST OF ALL IN THE UNI					NACES
North of England				2,018	
North-West of England .				84	
Yorkshire-West Riding .				358	
Yorkshire South				367	
Derbyshire				126	
South Staffordshire				2,160	
North Staffordshire	·			480	
Shropshire	•			230	
Lancashire	•			338	
C	•			13	
North Wales	•			70	
South Wales and Monmouth .	•				
	•			1,306	
Scotland	•			565	
Total .				8,115	

## LIST OF SMELTING AND METAL EXTRACTION COMPANIES IN THE UNITED KINGDOM.

#### LEAD.

Stock and Company, Penclawd, Swansea.

Sims, Willyams, Neville, and Company, Llanelly.

The Bury Port Smelting Company, Pembrey, Carmarthenshire.

Runcorn Smelting Company, Runcorn.

Thomas Somers, Bristol.

The Panther Lead Works, Bristol.

Sheldon, Bush, and P. S. Company, Redcliff Hill, Bristol.

Weston, Son, and Company, Bristol.

W. J. Cookson, and Company, Newcastle.

Locke, Blackett, and Company, Newcastle.

John Warwick, Newcastle.

Shield and Dinning, Haydon Bridge.

Howden Smelting Company, Newcastle.

Washington Chemical Company, Newcastle.

Enthoven and Sons, London.

Lock, Lancaster, and Company, London.

Pontifex and Wood, Farringdon Works, London.

Trustees Treffry's Estate, Par, Cornwall.

R. Michell and Son, Truro, Cornwall.

Peter Glover, Widness Lead Works, near Warrington.

Delafield White Lead Company, near Wrexham, Flintshire.

Adam Eyton, Llanerchymor, Holywell.

The Brymbo Company, Brymbo.

Walker, Parker, and Company, Dee Bank, Bagilt, and Newcastle. Governor and Company of Lead Smelters, Nenthead, Alston Moor,

W. B. Beaumont, Allendale, Alston Moor.

Benjamin Bagshaw, Eyam, near Bakewell.

Barker and Rose, Alport, Bakewell, and Sheffield.

Joseph Wass and Company, Lea Lead Works, Matlock, Bath.

Snailbeach Lead Company, near Shrewsbury.

Pontesford Smelting Company.

Meerbrook LeadWorks (Wass and Co.,) Meerbrook, Matlock, Bath.

Gibbs and Company, Bonsale Dale, Matlock.

#### LEAD-cont.

William Sperry, Via Gellia Lead Works, Cromford, Matlock, Bath.

Robert Howe Ashton, Castletown, Derbyshire.

J. Fairburn and Company, Middleton Dale and Bradwell.

T. Wilson and Company.

E. Backhouse, Darlington.

Greenside Mining Company, Penrith.

The Keld Head Mining Company, Wensleydale.

George York, Pateley Bridge.

Duke of Devonshire, Grassington.

The Duke of Buccleuch, Wanlock Head.

The Lead Hills Mining Company, Lead Hills.

The Hurst Mining Company, Hurst.

Lister, Robinson, and Company, Grinton Moor.

R. M. Jaques and Company, Arkengarthdale.

R. M. Jaques and Company, Old Gang.

The Blakethwaite Lead Company, Blakethwaite.

R. Milner and Company, Belde Hill.

The Swaledale Lead Company, West Swaledale.

Somersetshire:

Charterhouse, Blagdon, Bristol.

Mendip Mining Company.

Waldegrave Lead Smelting Company Limited, Mendips, near Wells.

East Harptree Lead Works, Limited, East Harptree, Bristol.

St. Cuthbert Works, Mendips, near Wells.

The Mining Company of Ireland Limited, Dublin.

#### LIST OF ALL THE ZINC SMELTERS.

Vivian and Sons, Swansea.

William Marsden, Oldland Hall, near Bristol.

Kenrick and Son, Wynn Hall, Spelter Works, Ruabon.

Mines Royal Copper Company, Neath (ceased to smelt).

Charles Titterton, Phœnix Zinc Works, Warrington Junction.

J. H. Dillwyn, M.P., Swansea.

J. Collingborne, Spelter Works, Warmley, Bristol.

Joseph Thompson, Spelter Works, Carlisle.

ZINC SMELTERS—cont.
The Bagilt Smelting Company, Bagilt.
Ryland Brothers, Warrington.
T. Gilby.
Joseph Wethered, Bristol.

#### Pyrites Precipitate Companies.

Duncan McKechnie, St. Helen's.
The Widnes Metal Company, Widnes.
The Tharsis Sulphur and Copper Company, Widnes.

,, ,, ,, Newcastle.
,, ,, ,, Birmingham.
,, ,, ,, Glasgow.

N. Mathieson and Company, Widnes.
The Runcorn Soap and Alkali Company, Runcorn.
Newton Heath Reduction Company, Manchester.
Muspratt Brothers and Huntley, Flint.
The Mostyn Copper Company, Mostyn.
Solomon Mease and Son, Newcastle.
William Russell and Company, Newcastle.
J. and W. Allan, Newcastle.
The Bede Metal Company, Newcastle.
W. Hunt and Sons, Leabrook, Wednesbury.
William Hunt and Company, Castleford.
H. Blair and Company, Kearnsley, Bolton, Lancashire.
William Haslam, Bolton, Lancashire.
Snell and Company, Runcorn.

#### ARSENIC.

Cornwall Arsenic Company, Hayle, Bissoe Bridge, Thomas Willis Field, Managing Partner.

LIST OF THE BEST HÆMATITE MINES IN THE WHITEHAVEN DISTRICT, WHICH INCLUDES FRIZZINGTON.

~	1 John Stirling, Esq., Montreal Iron Ore Works	. Moorkow, near Cleator	Moorkow, near Cleator John Jenkins, Esq., Manager.
CH	The Parkside Mining Co	Frizzington'.	Charles Fisher, Esq., Managing Director or Partner.
8	S. and J. Lindew	. Gutterby and Rig Rigg,	John Lindew, Esq., Managing Director or Partner.
_		near Cleator.	
*	The Salter and Eskett Park Mining Co., lim	. Eskett.	Joseph C. Brown, Esq., Managing Director.
9	S. W. Smith, Esq	. Frizzington	Mr. E. G. Hughes, Resident Manager.
6	Fletcher and Hodgett	. Frizzington	Alfred Hodgett, Esq., Managing Partner.
9	James Clarke, Esq.	. Birles, Frizzington .	James Clarke, Esq., Newton Heath, Manchester.
9	The Eskett Iron Ore Co.	. Eskett	Joseph H. Robinson, Esq., Managing Partner.
65	Fletchers, Miller and Co	. Eskett	W. Miller, Esq., Managing Director.
6	Hodgson and Co	. Yeathouse, Eskett .	John Hodgson, Esq., Managing Director.
-	Right Hon. Lord Leconfield	. Rig Rigg	James Davidson, Esq., Manager.
67	Bain and Votersur	.   Woodend mines, Eyre-	Bain and Paterson.
_		mont.	
9	Hannay and Co	· Frizzington	H. Woolcock, Esq., Manager (sold).
8	The Lamplugh Mining Co		Mr. Stowart, Manager.
7	The Crossfield Iron Ore Co	. Crossfield	H. M. Mackenzie, Esq., Managing Partner.
5	The Cumberland Iron Mining and Smelting Co. lim.	m. Winder	Thomas Mornely, Esq., Managing Director.
+	The Rig Rigg Iron Ore Co	. Rig Rigg	James Wilks, Esq., Managing Partner.
8	The Cleator Iron Ore Co	. Cleator	James Ainsworth, Esq., Managing Partner.
7	The Mowbray Iron Ore Co	. Mowbray, Frizzington	James Robertson, Esq., Manager.

#### 286 LIST OF ALL THE TIN PLATE MANUFACTURERS

LIST OF WORKS HAVING BESSEMER CONVERTERS IN GREAT BRITAIN IN 1872.

No.	Name and Situation of Works	Number of Converters	Capacity of Converters		
		ſ 2	Tons.	Cwt.	
1	Henry Bessemer and Co., Sheffield .		5	0	
_	71 D 10 7: " 101 m 11	$\left.\begin{array}{c}2\\2\\4\end{array}\right.$	10	0	
2	John Brown and Co., Limited, Sheffield	1 4	6	0	
3	Charles Cammell and Co., Limited, Sheffield	} 8	5	0	
4	Weardale Iron Co., Towlaw	4	21	U	
5	The Glasgow Bessemer Steel Co., Limited, Atlas Works, Glasgow	} 2	3	0	
6	Samuel Fox and Co., Stockbridge	ſ 2	5	0	
-	Works, Deepcar	1 2	3	0	
7	Lloyds, Foster, and Co., Old Park, Wednesbury	} 4	4	0	
8	Bolton Iron and Steel Works, Bolton .	4	5	0	
9	London and North-Western Railway, Crewe	} 2	3	0	
10	Lancashire Steel Co., Gorton	4	5	0	
11 12	Mersey Steel and Iron Works, Liverpool Manchester Steel and Railway Plant	1	5	0	
_	Co., Gibraltar Works, Newton Heath, Manchester	4	3	0	
13	Barrow Hæmatite Steel Co., Barrow .	18	6	0	
14	The Dowlais Iron Co., Dowlais	6	5	0	
15	Ebbw Vale Co., Ebbw Vale	7	5	0	
16	Steel Ordnance Co., Limited, Greenwich	2	5	0	
17	West Cumberland, Workington	4 2	71	0	
18	Phœnix Iron Co., Rotherham	2	31	0	
19	Carnforth Hæmatite Iron Co., Limited.	2	0	0	

#### LIST OF ALL THE TIN PLATE MANUFACTURERS. 1872.

No.	Name of Works	Name of Firm	Where situate
1	Aberdulais .	JoshuaWilliams&Co.	Neath, Glamorganshire.
2	Abertillery .	Philip S. Milliss .	Newport, Monmouth- shire.
3	Beaufort or Lower Forest	BeaufortTinPlateCo.	Swansea, Glamorgan- shire.
4	Bradley .	Thompson, Hatton, & Co.	Bilston, Staffordshire.
5	Broadwaters .	Thompson, Hatton, & Co.	Kidderminster, Worces- tershire.
6	Brockmoor .	Budd & Co	Brierley Hill, Stafford- shire.
7	Caerleon .	J. G. & A. Moggridge	Caerleon, Monmouth- shire.
8	Carmarthen .	Thomas Lester & Co.	Carmarthen, Carmar- thenshire.

LIST OF ALL THE TIN PLATE MANUFACTURERS-cont.

No.	Name of Works	Name of Firm	Where situate
9	Coatbridge .	Coatbridge Tin Plate	Coatbridge, Glasgow.
10	Cookley .	John Knight & Co	Kidderminster, Worces- tershire.
11	Cwm Avon .	Governor & Co.,	Taibach, Glamorganshire
12	Cwmfelin .	Copper Miners Cwmfelin Tin Plate Co.	Swansea, Glamorgan- shire.
13	Dalen	Philips, Ninnes, &Co.	Llanelly, Carmarthen-
14	Derwent .	W. Griffiths & Co	Workington, Cumber-
15	Garth	Garth Iron and Tin Plate Co.	Newport, Monmouth- shire.
16	Gwendraeth .	J. Chivers & Son .	Kidwelly, Carmarthen- shire.
17	Hendy	Edmd. Boughton & Co.	Llanelly, Carmarthen- shire.
18	Horseley Fields	Osier Bed Iron Co	Wolverhampton, Staf- fordshire.
19	Horseley Fields or Wilden	E. P. & W. Baldwin	Ditto.
20	Landore .	LandoreTinPlateCo.	Swansea, Glamorgan- shire.
21	Lydbrook .	Richard Thomas & Co.	Ross, Herefordshire.
22	Llwydarth .	Llwydarth Tin Plate	Bridgend, Glamorgan-
23	Macken .	Macken Iron and Tin Plate Co.	Newport, Monmouth- shire.
24	Melyn	Leach, Flower, & Co.	Neath, Carmarthens.
25	Pentyrch and MelinGriffith	T. W. Booker & Co.	Cardiff, Glamorgan- shire.
26	Pontardawe .	W. Gilbertson & Co.	Swansea, Glamorgan- shire.
27	Pontnewydd.	B. Conway & Co	Newport, Monmouth- shire.
28	Ponthur .	John Jenkins & Co.	Caerleon, Monmouth- shire.
29	Pontrhydyrnn	Conway Brothers .	Newport, Monmouth- shire.
30	Pontymister .	Banks & Co	Ditto.
31	The Old Castle	The Old Castle Iron and Tin Plate Co., Limited	Llanelly, Carmarthen- shire.
32	Tividale .	Budd & Co	Tipton, Staffordshire.
33	Upper Forest	Edward Bagot & Co.	Swansea.
34	Ynispeullwch	Ynispeullwch Tin Plate Co.	Swansea, Glamorgan- shire.

288

## PRICES OF MERCHANT BAR IRON AT LIVERPOOL FROM 1806 TO 1872.

Date	Highest Price in the Year	Lowest Price in the Year	Average
A.D.	£ 1. d.	£ 1. d.	£ 1. d.
1806	17 10 0	16 0 0	16 15 0
1807	17 0 0	15 0 0	16 0 0
1808	15 0 0	14 10 0	14 15 0
1809	16 0 0	14 0 0	15 0 0
1810	15 0 0	14 0 0	14 10 0
1811	15 0 0	14 0 0	14 10 0
1812	14 5 0	12 15 0	13 10 0
1813	13 0 0	12 0 0	12 10 0
1814	14 0 0	12 0 0	13 0 0
1815	13 10 0	11 0 0	12 5 0
1816	11 10 0	8 15 0	10 2 6
1817	13 0 0	8 10 0	10 15 0
1818	13 0 0	10 0 0	11 10 0
1819	12 10 0	11 0 0	11 15 0
1820	11 0 0	9 10 0	10 5 0
1821	9 10 0	8 15 0	9 2 6
1822	8 10 0	8 0 0	8 5 0
1823	8 10 0	8 0 0	8 5 0
1824	13 0 0	8 10 0	10 15 0
1825	15 0 0	11 10 0	13 5 0
1826	11 10 0	9 10 0	10 10 0
	10 0 0	8 15 0	9 7 6
1827	9 10 0	8 5 0	8 17 6
1828	8 5 0	7 0 0	7 12 6
1829	6 15 0	6 5 0	6 10 0
1830	6 10 0	5 15 0	6 2 6
1831 1832	6 5 0	5 10 0	5 15 0
	7 15 0	5 15 0	6 17 6
1833	8 5 0	7 10 0	7 7 6
1834	8 5 0	7 10 0	7 7 6
1835	11 10 0	8 0 0	9 15 0
1836	10 10 0	7 5 0	8 17 6
1837	9 10 0	10 0 0	9 15 0
1838	10 5 0	9 10 0	9 17 6
1839		7 10 0	8 10 0
1842		5 10 0	6 2 6
1843	0 20 0	4 15 0	5 10 0
1844	6 5 0	6 5 0	8 5 0
1845		8 10 0	9 0 0
1846	9 10 0		
1847	9 10 0		9 2 6
1848	9 0 0		7 10 0
1849	6 10 0	5 0 0	5 15 0
1850	6 15 0	5 10 0	6 2 6
1851	5 0 0	4 10 0	4 15 0
1852	9 0 0	4 10 0	6 15 0
1853	9 10 0	7 10 0	8 10 0
1854	9 15 0	9 0 0	9 7 6

289

PRICES OF MERCHANT BAR IRON AT LIVERPOOL. FROM 1806 TO 1872—continued.

Date	Highest	Price Year	in the	Lowest Price in the Year					
A.D.	£	8.	d.	£	s.	d.	£	<b>s.</b>	d.
1855	9	0	0	7	0	0	8	0	0
1856	8	10	0	8	0	0	8	5	0
1857	8	5	0	7	5	0	7	15	0
1858	7	5	0	6	10	0	6	17	6
1859	6	15	0	6	5	0	6	10	0
1860	6	10	0	6	5	0	6	7	6
1863	7	15	0	6	0	0	6	17	6
1864	7	15	0	7	5	0	7	10	0
1865	7	15	0	7	0	0	7	7	6
1866	7	5	0	6	5	0	6	15	0
1867	7	5	0	6	0	0	6	12	6
1868	6	5	0	6	0	0	6	2	6
1869	6	15	0	6	0	0	6	7	6
1870	7	0	0	6	0	0	6	10	0
1871	6	15	Ò	6	15	Ô	6	15	0
1872	16	0	0	11	0	Ò	13	12	6
1873	16	ŏ	ŏ	14	ŏ	Ŏ	This being September we cannot give average until January, 1874.		

#### COMPENDIUM OF MECHANICS.

#### WEIGHTS AND MEASURES.

#### IMPERIAL STANDARD WEIGHTS AND MEASURES.

#### STANDARD YARD.

THE Standard Yard, when compared with a Pendulum vibrating seconds of mean time in the latitude of London, in a vacuum at the level of the sea, is in the proportion as 36 to 39 inches, and 1393 ten thousandth parts of an inch.

The Rood of Land shall contain 1210 square yards, an Acre, 4840 square yards, or 160 square perches, poles, or rods.

#### STANDARD POUND.

A Cubic Inch of distilled water, weighed in air by brass weights, at the temperature of 62 degrees Fahrenheit, the barometer being at 30 inches, is equal to 252 grains and 458 thousandth parts of a grain, of which the Standard Troy Pound shall contain 5760.

#### STANDARD GALLON.

The Standard Gallon shall contain 10 Pounds Avoirdupois weight of distilled water weighed in air, at the temperature of 62° Fahrenheit, the barometer being at 30 inches. It shall contain 277¼ cubic inches.

#### STANDARD FOR HEAPED MEASURE.

The Standard Bushel, for Heaped Measure, shall contain 80 pounds Avoirdupois weight. It shall be 19½ inches diameter, and 7.4272 inches deep inside, with a plain and even bottom, and contain 2218.192 cubic inches.

#### 1. MEASURES OF LENGTH.

12 inches	12	2 inche								233	1	foot.
3 feet	3 fe	feet								=	1	yard.
51 yards	51	yards								=	1	pole or rod.
40 poles	40	poles								=	1	furlong.
8 furlongs,	8 f	furlon	gs, 176	0 yards,	or 5280	feet				-	1	mile.
3 miles =	3	mile	= 1	league, n	narked le	a.	1 11 mile	= 1 Is	talian	mi	le.	
				French le				= 1 R				
32 do. =	32	do.	= 1	Spanish	league.		13 do.	= 1 S	cotch:	mil	e.	
4 do. =	4	do.	= 1	German	mile. ·		13 do.	= 1 I	rish m	ile.		
31 do. =	31	do.	= 1	Dutch m	ile.		691 mi	les near	ly =	1 I	)eį	g., marked °.
40 poles 8 furlongs, 3 miles = 2 <sup>3</sup> / <sub>4</sub> do. = 3 <sup>2</sup> / <sub>5</sub> do. = 4 do. =	40 8 f 3 23 4	poles furlon miles do. do. do.	gs, 176  = 1 = 1 = 1 = 1	10 yards, league, n French le Spanish German	or 5280 narked le eague. league. mile.	feet	$\begin{array}{c} \frac{11}{12} \text{ mile} \\ \frac{3}{4} \text{ do.} \\ \frac{1}{22} \text{do.} \\ \frac{1}{11} \text{ do.} \end{array}$	= 1 Is = 1 S = 1 S = 1 Is	talian lussian cotch	mil nile	le.ers	furlong. mile.

#### VARIOUS FRENCH MEASURES OF FREQUENT REFERENCE.

A point, is equal to	. 0148025 English inches.	
A line	. •088815 ,,	
A millemetre .	. •039371 ,,	
A centimetre .	. •39371 ,,	
An inch (pouce).	. 1.06578 ,,	
A decimetre .	. 3.9371 ,,	
A foot	. 12.78933 ,,	
A metre .	. 39·371 ,, or 3·2809 English:	ft.
A toise (fathom)	. 6.394 English feet.	
A league .	. 14591·1 ,, or 4863·7 English yards.	
A square inch .	. 1.13582 English square inches.	
A cubic inch .	. 1.21063 ,, cubic ,,	
A cubic metre .	. 35.316 ,, cubic feet.	

#### 2. MEASURES OF SURFACE, OR SQUARE MEASURE.

144 square inches				= 1 square foot.
9 square feet				= 1 square yard.
301 square yards				= 1 square pole.
40 square poles				- 1 square rood.
4 roods, or 4840 s	quare yards	в .		= 1 square acre.
640 square acres				= 1 square mile.
1089 Scotch acres				= 1369 Eng scres

#### 3. MEASURES OF SOLIDITY OR CUBIC MEASURE.

1728 cubic inches .			= 1 cubic foot.
27 cubic feet .			= 1 cubic yard.
1663 cubic yards .			= 1 cubic pole.
64,000 cubic poles			= 1 cubic furlong.
512 cubic furlongs			= 1 cubic mile.

#### 4. MEASURES OF CAPACITY.

#### LIQUIDS.

8.665 cubic inches = $\frac{5}{16}$ tb. of water			= 1 gill.1
4 gills = 34.659 do. = 14 tb. do			= 1 pint.
2 pints = 69.318 do. = 21 ths. do		•	= 1 quart.
4 quarts = 2771 do. = 10 fbs. do			= 1 gallon,

#### GRAIN, FRUIT, ETC.

2 gallons					=	1 peck.	
4 pecks, or	2218-192	cubic	inches		=	1 bushel.	
8 bushels					=	1 quarter.	
5 quarters					=	1 load,	

#### 5. MEASURES OF WEIGHT.

#### TROY.

24 grains .	•			. = 1 pennyw	eight.
20 pennyweights			•	. = 1 ounce.	
12 ounces .	•	•	•	<ul> <li>= 1 pound.</li> </ul>	

#### AVOIRDUPOIS.

27-34375 troy	grains			=	1 dram.	
16 drams				=	1 ounce.	
16 ounces				=	1 pound.	
14 pounds				=	1 stone.	
2 stones				-	1 quarter.	
4 quarters, or	112tbs.			=	1 cwt.	
20 cwt.				-	1 ton.	

#### BRITISH SPECIAL MEASURES.

#### 1. LINEAL MEASURES FOR LAND.

7.92 inches	١.		=1	link.
100 links, or 22 yards			= 1	chain.
80 chains			- 1	mile.
69·121 miles			= 1	geog. degree.

<sup>&</sup>lt;sup>1</sup> Called also, in the north of England, a Jack or Noggin. In some counties, the Half-pint is erroneously termed a Gül.

#### 2. SQUARE MEASURES FOR LAND.

62.7264 square inches		=	1	square	link.
10,000 square links .		86	1	square	chain
10 square chains .		-	1	square	acre.

#### 3. NAUTICAL MEASURES.

6082.66 feet			= 1 nautical mile.
3 miles			= 1 league.
20 leagues			= 1 degree.
360 degrees			= the earth's circum-
			ference.

#### MISCELLANEOUS SPECIAL MEASURES.

6 lineal feet					= 1 fathom.
100 square fe	et				= 1 square of flooring.
272 square ft.	at 14 i	nches in	thickne	888	= 1 rod of brickwork.
600 square fee					= 1 load.
40 cubic feet					
50 cubic feet				•	= 1 ton or load.
40 cubic feet					= 1 ton of shipping.
120 deals					= 1 hundred.
120 nails					= 1 hundred.
1200 do.					= 1 thousand.
500 bricks					= 1 load.
32 bushels of	lime			·	= 1 do.
36 do.	sand	•	•	•	= 1 do.
22 cwt.	Duna	:	•	•	= 1 fodder of lead (Stockton).
21 do.	•	:	•	:	= 1 do. do. (Newcastle).
191 do.	•	•	:	•	= 1 do. do. (London).
108 cubic feet	•	•		•	= 1 stack of wood.
42 gallons	•	•	•	•	= 1 tierce \
63 do.	•	•	•	•	= 1 hogshead old
84 do.	•	•	•	•	= 1 puncheon wine
126 do.	•	•	•	•	
252 do.	•	•	•	•	= 1 pipe measure.
36 do.	•	•		•	= 1 tun   = 1 barrel
54 do.	•	•	•	•	
72 do.	•	•	•	•	= 1 hogshead   old ale
	•	•	•	•	= 1 puncheon   measure.
108 do.	•	•	•	•	= 1 butt
36 bushels, or	28 cwt	•	•	•	= 1 chaldron of coals (London).
63 cwt.	•	•	•	•	= 1 do. do. (Newcastle.
88 fbs.	•	•	•	•	- 1 bushel of coal.
56 do.	•	•	•		= 1 do. flour or salt.
60 do.	•	•	•	•	= 1 do, wheat,
47 do.	•	•		•	= 1 do. barley.
38 do.	•				= 1 do. oats.

#### MISCELLANEOUS SPECIAL MEASURES .- Continued.

1 gallon of sea water . . = 10·32 bs. avoirdupois. 1 ,, oil . . . = 9·32 ,,

l " proof spirits . = 9.3 "

The old ale gallon contained 282 cubic inches; and the old wine gallon 231.

The French litre, or standard measure of capacity for liquids, contains 61.028 cubic inches, or about '453 of the imperial gallon.

#### WEIGHT OF WATER.

#### Maximum density of water 42° Fahrenheit,

Freezing point 32° Fahrenheit, at which point it has expanded 17th of its original bulk.

62:5 bbs. avoirdupois = the weight of 1 cubic foot.

-03617 . = . 1 ,, inch.

-434 . = . 1 lineal foot of 1 inch square.

49·1 . = . 1 cylindrical foot.

-02842 . = . 1 ,, inch.

-341 . = . 1 lineal foot 1 inch diameter.

11·2 imperial gallons = . 1 cwt.

224 . = . 1 ton.

1:8 cubic feet . = . 1 cwt.

35.84 . . = . . 1 ton.
1 cubic foot of water = 6½ imperial gallons, and
1 cylindrical foot = about 5.

#### METALS

## IN CONNEXION WITH THE ARTS, CIVILISATION, AND SOCIAL PROGRESS.

Gold, the most ancient, the most ductile, and the most valuable of all metals, has always ministered in a large degree to the perfection of ornamental art. Its opacity, ductility, and durable brilliancy give it a value in Gold Leaf far beyond the market price of the metal. The consumption of Gold Leaf is enormous, the manufacture of which is one of the staple trades of London

and Birmingham. It is not used in medicine, but is valuable and indeed indispensable in the wonderful art of photography. It is difficult to oxidize Gold, it being proof against the effects of nitric acid. Gold is rarely used in the arts in a pure state; the embellishment of china with Gold is effected by laying the pattern in reduced liquid Gold on to the china: after being burnt in, the brilliancy of the colour is brought out by burnishing the Gold with bloodstones. Gold passes as money in all civilised countries, the standard value being regulated for all the world by the Bank of England.

Silver is readily taken as money in all parts of the world, being the standard in China and some other eastern countries. Its ductility and opacity give it value for embellishing japannery as leaf Silver, for which it is largely used. Large quantities of this metal are likewise consumed by our chemists in making lunar caustic or nitrate of Silver. It is also dissolved very extensively in Sheffield and Birmingham for electro-plating spoons and forks and other articles made in these towns.

Copper goes into consumption for a thousand purposes for which it is more durable and useful than iron, being less liable to oxidize than the former metal. It is the basis of blue vitriol and verdigris, and enters largely into the constitution of brass, this metal being principally composed of spelter with various combinations of Copper. It was formerly used exclusively to protect ships' bottoms; Muntzs's Patent Metal has, however, for years partially superseded it: Copper, however, enters largely into the combination of Muntzs's Rival Sheeting.

Tin is one of the most useful metals we have in manufactures; it willingly covers and tins over the surface of Iron, effectually preventing oxidization of the former metal, and by this combination Tin Plates are made so useful for the manufacture of culinary utensils and thousands of articles too numerous to mention. The beautiful dish covers made at Wolverhampton, so bright and clegant, are a striking proof of the value of Tin as an elegant covering of Iron. The greatest consumption of Tin takes place in the manufacture of these Tin Plates. Tin is not much used as a medicine, but often consumed as a mixture in the crucible with Gold, Silver, Lead, Copper, and Antimony.

Antimony produces some of our most valuable medicines, and is largely used by the type founders; being one of the most brittle metals it imparts a resisting power to the type, which renders this metal indispensable at the type foundry.

296 METALS.

Zinc is the Spelter of commerce, and is the chief metal used in making brass; it is likewise valuable in the galvanic battery, and, rolled into sheets, is largely used in metallurgical manufactures. A preparation of Zinc is also used for white paint.

Lead is one of the heaviest and most useful metals, and has been known and used from the most ancient times. Being soft and pliable, and melted at a low temperature, it is used largely in the arts, and is an indispensable mixture for most other metals.

Mercury is consumed very largely indeed by the chemists in the manufacture of various mercurial salts and sublimates, pills and ointment. It is useful for many purposes in the arts. The world's produce comes to England; the consumption has increased so much during the last few years as to enhance the price of Mercury in the market very considerably.

Cobalt, as indigo blue, is the only fast colour for cottons, woollens, and silken goods. Just so Cobalt stands with regard to the blue colour which has to endure the fiery ordeal of the potter's oven; all the blue colour which we see on china and earthenware is made from Cobalt, hence Cobalt is indispensable in these manufactures.

Iron.—Iron is the hardest,1 the most abundant, and useful of all metals; it is deposited in various ways in all parts of the world. All newly discovered countries develop deposits of Iron in the crust of the earth. The best in the world is produced in England, from the estates of the Earl of Dudley, at Dudley; the noble Earl Granville, at Lillieshall: and the Duke of Devonshire, at Barrow-in-Furness. The quantities made will be found in the proper place of this book. Its importance in the arts and manufactures is too well known to require comment here; it forms the basis of some of the most invaluable medicines in the Pharmacopæia, and supplies the material for the great steamships and railroads. its manufacture, and the industries connected with it, it employs more men, creates a greater amount of wealth, and is of much greater importance to the stability and prosperity of these kingdoms than any other trade, industry, or interest, carried on in the empire.

Of course we include Steel.

Iron is popular with the profession as a tonic in various combinations; perhaps its preparations are more numerously recognised by the Pharmacopæia than any other metal, the most popular preparations are:—

```
Ferri Carbonas saccharata.1
      Citras.
      et Ammoniæ Citras.
  ٠.
      " Quiniæ Citras.
      Iodidum.
      Oxidum Magneticum.
              Nigrum.
      Perchloridi Liquor.
     Pernitratis Liquor.
     Peroxidum.
                 hydratum.
     Phosphas.
     Potassio tartras.
     Pulvis.
     Sulphas.
              exsiccata.
              granulata.
Ferridcyanide of Potassium.
Ferrocyanide ,,
Ferrum redactum.
        Tartaratum.
```

We adopt the nomenclature of the British Pharmacopeeia, published 1864, in all the names for this and the preparations of other metals.

The Tr. Ferri Perchloridi, or Steel Drops, sold in the druggists' shops, is of course made of Iron, and is a most invaluable medicine.

## GENERAL TABLE OF METALS.

Abbrevia	Chemical E	Chemical Equivalente	When and by whom	Specific Gravity,	Melting	
tions or Symbols	Hydrogen = 1	Oxygen =100; Ify.=12:5	discovered as pure metals		Fahrenheit's Thermo- meter	General Bemaeks
1. Goin (Aurum) . Au. 98-33	98.33	1229-16		19-26	2016°	1. The most ancient metal. Found in small quantities in all parts of the world. At the beginning of this contury South America was the largest source of supply; now, the supply comes in the following order—Australia, Cali
2. Silven(Argentum)Ag. 108·00 1350·00	108.00	1350.00		10.17	1837°	fornia, New Zealand, Columbia and other parts of America, and Russia.  2. Found native in sulphurets, and meet of the lead ores. Our great supply is from South America. Some of our English lead
3. Inox (Ferrum) . Fc.	28.00	3500)		7.78	2786°	nines are rich in silver.  3. The most universally diffused mineral. Chief supply from Barrow-in-Furness, Millom, Erizaneous and other naris of Cambeland.
						FIGURE OF A CONTROL OF A CONTRO
			Known to the			platinum and potassium, espable of being welded, or hammered or pressed together, two several pieces into one solid mass. Used

	·	
4. Found native, frequently in small quantities, and mines wrought in every quarter of the globo. Brighand almone chiefly Cornwall and Devon) formerly yielded about two-thirds of the entire produce of the world. Copper is used for electro-planting and electro-engaving to a large catent; this metal is likewise the basis of the Cupri Sulphas of the British Phurmacopen, which is very largely used, and an indisponsable salt in every surgery and druggists shop. It is also consumed largely by the agreellurists. Blue vitrol is a powerful caustic and detergent, and supposed to leave the parts under its influence by conservations when Arenis sulder its influence by conservations when Arenis Sulfammation than its more	5. Found chiefly in Austria and Spain, also in Japan, South America, Mexico, China, &c. frequently found pure, or sulphuret and other ores 50 to 80 per cent.; rich in pure mercury. Used largely to make mirrors and barometers at the gold diggings to collect the gold, also in making vermillon, and is the lasis of many of the most useful medicines in the Usrtish Pharameopen, among which may be mentioned Hydrargyr cum creft and numerous other salts and preparations, detailed	nt p. 300. Chief ore, galona or sulphuret of lead. Chief supply, England, Spain, Ireland, Isle of Man, Scotland; sometimes found native in Alston Moor, Cumberland. Lead renders great
1096°	39° Delow Zero	6125
8.89	13.60	11.35
395.70	1250.90	1294.50
31.66	100.07	103.56
4. Согрив (Сиргит) Си. 31-66 395-70	5. Mercury (Hyddrargyrum) Hg.	6. Leav (Plumbum) Pl. 103-56

GENERAL TABLE OF METALS-Continued.

When and he whom Gracity Point	discovered as pure Weight Fal metals 60°=1.00	assistance to the arts, the earbonate of load forms our white lead of commerce, ground in coll it is the most durable medium for other coloured paints. In medicine lead is invaluable. The British Planracoperis has the Unguentum plumbi carbonatis and Unguentum plumbi carbonates and Unguentum plumbi subacetatis, and other preparations well known to the pharmaceutist.  7.30 412º 7. Cornwall, Maluces, and Banca are the only commence of surveil worsh ratios, found in wears.	Basil Valen. 6-70 810° 8. C	complete. From this we get the Vinum an-
quivalents	Oxygen = 100; IIy.=12.5	735.24	1612:90	
Chemical Equivalents	Hydrogen =1	58.82	129.03	
Abbrevia-	tions or Symbols	7. Tin (Sannum), Sn.	8. Антімонт (Sti- bium) Sb.	

Antimonium tartaratum, Antimonii oxidum, Antimonii oxyaulphuretum. Antimonii potassio tartras, Antimonii sulphuretum. Antimonii potassio tartras, Antimonii sulphuretum. Antimonii potassio tartras, Antimonii sulphuretum autreum. Antimonii sulphuretum precipitatum, and othors.  9-80  9-80  9-80  9-80  9-80  9-80  7-00  7730  10. (Spelter). Chief supply, Silesia and Bolgium. Sancaoy. Used largaly in medicino, see p. 306.  700  7130  10. (Spelter). Chief supply, Silesia and Bolgium. Since the removal of the duty on foreign, recylithe is smelted in this country, although the ores are found in various localities. Very malleable at 212° Partr. Chalmine, one of the chief ores of zinc, was long used before it was known as a distinct metal. Used largely in medicine, see p. 306.  700  11. Very soft and brittle, of a steel-gray colour; readily oxidises. The deadly poison (used largely) in medicine, see p. 286), white argent of commerce, is the oxide of arsenic; it hardens any metal with which it may be mixed, and is midaliting, sued with lead, I to 100, in making shot. Chief supply from Saxony and Bohemis. The white oxide is destructive to all animal life. The Liquor arsenically and sympatic propersion are an effective remedy in neuralistic, and precipitate and precipitation of the colour stream of the supply from sureminiation are an effective remedy in neuralistic, and precipitation of the sureminiation of the colour of the propersion of the colour o
9-80
8.6
1536
3
886.92 Agricola . 1530 406.59 Paracelous . 1535 937.50 Brandt 1733
6 8 9
886-92 406-59
70.95 32.62 75.00
. Z <sub>N</sub> .
9. Візмета Ві. 10. Zімс Zм. 11. Авзанто Ав.
11.

GENERAL TABLE OF METALS-Continued.

		Abhrevia-		Chemical Equivalents	When and he whom	Specific	Melting	
		Symbols	Ilydrogen =1	Oxygen =100; Hy.=12.3	discovered as pure metals	or Weight Water at 60°=1'00	Fahrenhelt's Thermo-	General Rhmarks
					A.D.			
								tonic; some foolish girls are weak enough to
12.	12. CORALT .	. Co.	29.52	368-99	368-99 Brandt 1733	8.53	28002	introving their complexion.  12. Reddoving their complexion.  The metallic atter.  Orito of column 1-iii.
13.	13. Рідтінти Рt.	Pt.	89.86	1233-50	1233.50 Charles Wood 1741	20.08	Ox. Ify.	lint blue, med used in the arts.  13. Very scarce, beautiful white metal, almost indestructible; nearly as valuable as gold.
	14. NICKEL .	. Ni.	29.57	369.68	Cronstedt . 1751	8.27	2300°	very ducties and malloable; less hard than iron. Found in the Ural Mountains, South America, and Spain.  14. From Germany and Sweden. Used in the manufacture of Gorman silver; best, 8 copper, 2, nickel, 3½ zinc; common, 8 copper, 2
15.	15. Manganese Mn.	E. Mn	27.67	345.90	Gahn 1774	6.85	S. F.	nickel, 4 zinc. Used also in the manufacture of porvelain.  15. Not used in the metallic state. The manganese of commerce (black oxide) is largely
16.	16. Tungsten (Wolf-ram)	N(Wolf-W.	94.64	1183.00	1183-00 Delhuyart . 1781	17.50	Do.	used in the manufacture of bleaching powder.  16. White, hard, brittle; found as tungstate of lime, iron, and manganese; not used in the
17.	<ol> <li>Тептивним Те.</li> <li>Москвоемим Мо.</li> </ol>	I. Te.	66-14	801.76	Müller 1782 Hielm 1782	0.10	650° Ox. Hy.	arts. 17. Colour, tin white; not used in the arts. 18. White, brittle, and very infusible its native

sulphuret was long taken for an ore of lead, and is frequently found united with lead ore.  19. A black prodex, sight metalle lustre, very combustible; burns with a white light.  20. Rare, and very hard; found in slags of ironsmelting furnaces, in bright red crystals.  21. Whitish and brittle; not used in the metallic state. Its combinations form many useful colours to dyers, colico-printers, and potters. Black powder; becomes lustrous under a burnisher.  22. Black powder; becomes lustrous under a burnisher.  23. Pound associated with platinum ores, which metal it resembles. It is hard, ductile, and malleable.  24. Whitish, and very hard. Has been used for the points of pens.  25. Gray and brittle; produces, in its solutions, many brilliant colours, hence the name(Iris, the Rinnbow).  26. Grayish white, porous, and assuming a metallic lustre when compressed.  27. White, brittle; of no use in the arts.  136° 28. The lightest solid substance, and a most remarkable metal; it asso strong an affinity for oxygen, that it takes free upon being thrown upon water. Forms the metallic base of potash of commerce. This metallic base of potash of commerce. This metallic base of potash of commerce. This metallic wine to prevent spontancous combustion; owing to its great affinity for water, a few
Do. Do. Do. Burns freely in air Do. Do. Do.
9·00 6·30 6·60 11·80 10·00 
. 1789 . 1790 . 1757 . 1802 . 1803 . 1803 . 1803 . 1803
750·00 Klaporth . 1789 303·66 Greger 1790 351·82   Tauguelin . 17.57 1153·72   Hatchett . 1802 651·39   Do 1803 1233·50   Tennant . 1803 575·00   Hissinger and Berzelius . 1807 487·50   Davy 1807
750·00 303·66 351·82 1163·72 651·39 1233·50 487·50
60-00 24-29 28-15 92-30 52-11 98-68 99-56 46-00 39-00
19. Uranium U. 20. Titanium Ti. 21. Chromium Cr. 22. Collumbium, or Tantadium Col. 23. Palladium Rd. 24. Rhodium R. 25. Iridium Ir. 26. Osmium Os. 27. Cerium Co. 28. Potassum (Ka-lium) K.
19. U 20. T 22. C 24. B 26. O 26. O 27. C 28. P

# GENERAL TABLE OF METALS-Continued.

		Abbrevia-		Chemical Equivalents	When and hy whom	_	Specific	Melting	
		or Symbols	Hydrogen =1	Oxygen =100: Hy.=12.5	discovered as pure metuls.		or Weight Water at 60°=1.00	F	GENERAL REMARKS.
									pieces thrown into a basin full of water, cause instant combustion, giving a brilliant
ô	29. Sodium (Natro-nium)	nium) Na.	22.97	287-17	287·17 Davy 1807	1807	26.0	190°	light in a dark room.  29. The metallic base of sods. Soft and malleable, resembling potassium in many features. Theorem on manyer is According
0.	30. Вавісм Ва.	Ba.	68.64	858-01	Do 1807	1807	4.00	Melts below 30.	0
-	31. Strontium Sr.	Sr.	43.84	548.03	548.02 Do 1807	1807	:	rodness	31. White, solid, and heavy, rapidly absorbs
									object, the meanire basis of an earth round in a pale green mineral at Strontian, in Argyleshire. Nitrate of strontia gives a fine red colour in fiveworks; used to make the red fine in theatres, and flowecks at
63	32. Calcium.	. Ca.	20.00	250.00	Do 1807 \$10 to 8.0	1807	\$.0 to 8.0	•	great fetos.  32. A brilliant white, and highly inflammable; the metallic base of lime. 20 rants calcium.
က်	33. CADMIUM	Cd.	55.74	22.969	696-77 Stromeyer , 1818	1818	8.60	4150	8 parts oxygen = common lime, 33. White, like tin; too scarce to be used in the arts; sometimes the oxide (yellow) is used
498	34. Latrica Li.	Li.	6.43	80.37	80.37 Arfundson , 1818	1818	:	:	as a pigment  84. Resembles potassium; obtained by the galvanic battery from lithia; an alkaline base.

36. Silicicum         36. Silicicum         37. Silicicum         18.34         Almost infusible         35. Silicicum         Almost infusible         35. Silicicum         Almost infusible         35. Silicicum         Almost infusible         35. Silicicum         Almost infusible         36. Thack powder, destitute of lustree.         37. Alternature         38. Dark gray; the base of glucina, which is only of finsion.         Alternature         38. Dark gray; the base of glucina, which is only of finsion.         Alternature         39. Alternature         39. Alternature         30. Alternature <th></th>												
Si.         21-35         266-82         Berzelius         1824         1837         Almost initisible           Al.         13-69         1771-17         Wöhler         1828         2.68            Gl.         26-50         331-26         Do.          1828          Difficult of fusion.           Y.         32-20         402-51         Do.          1828          Of fusion.           Y.         32-20         402-51         Do.          1828          Of fusion.           Y.         32-20         402-51         Do.          1829         0-402         Infusible of fusion.           Mg.         12-67         158-35         Bussy          1829         2-24         Volabile at white heat.           Di.         48-00         600-00         Mosender r.         1830             Er.          Do.          1841             Tr.          Do.          1843             Ra         62-11         652-49         Kalus		36. Black powder, resembling charcoal. 37. It was very difficult to procure in the metallic	chemist has called attention to it, and ob- tained sufficient to declare it very malleable, bright and beautiful, like silver, and not affected by the ordinary acids; now used	very Ingely in the area, particularly at Birmingham.  18. Dark gray; the base of glucina, which is only found in three rate minerals—the emerald, here! and suclease.	10. Dark iron gray; when ignited in open air it	U. Brilliant and white, the metallic base of	12. White, like silver; good electric-conductor.  13. Dark gray metallic pawder; not used in the	14. 15. The metallic base of orbin, a dark yellow	46. Hypothetic base of terbia; properties little	47. One of the (so-called) noble metals; closely	18. [Recently discovered to be identical, Niobium 19. [ is retained as the name.	51.
Si.         21:35         266-82         Brexelius         1824         1:857           Ai.         13:69         171:17         Weder.         : 1824            Ai.         13:69         171:17         Weder.         : 1828            Th.         26:50         331:26         Do.          1828            Th.         69:59         744:90         Berzelius         : 1829            Mg.         12:67         158:35         Bussy          1829         2.24           Ln.         68:55         856:89         Seftström          1839            Di.         48:00         600:00         Do.          1843            Tr.           Do.          1843            Tr.                 Ra         62:11         652:49         Kalus              Nb.                 <									4	4	4 4 4	-
Si.         21:35         266:82         Berzelius         1824           Ai.         13:69         171:17         Wökler         1828           Y.         32:20         402:51         Do.         1828           Th.         59:59         74:49         Berzelius         1829           Mg.         12:67         158:35         Bussy         1829           Di.         48:00         600:00         Mosander         1839           Tr.          Do.         1843           Tr.          Do.         1843           Tr.          Do.         1843           Ra         62:11         652:49         Kalus         1843           Ra         62:11         652:49         Kalus         1845           Nb.          Do.         1845           Nb.          Do.         1845           Nr.         Do.         1845         1845           Nr.         Do.         1845         1845           Nr.         Do.         1845         1845           Nr.         Do.         1845         1846           Nr.	Almost	::		Difficult of fusion.	Infusible	Volatile a	::	::	:	:	::	:
. Si. 21:35 . Zr. 33:62 . Al 13:69 . Gl. 26:50 . Th. 59:59 . Mg. 12:67 . Ln. 48:00 . Di. 48:00 . Tr		2.58		ŧ	9.402	2.24	::	::	:	9.8	::	:
. Si. 21:35 . Zr. 33:62 . Al 13:69 . Gl. 26:50 . Th. 59:59 . Mg. 12:67 . Ln. 48:00 . Di. 48:00 . Tr	. 1824	1824			. 1828		. 1838		. 1843	. 1844	. 1845	. 1849
. Si. 21:35 . Zr. 33:62 . Al 13:69 . Gl. 26:50 . Th. 59:59 . Mg. 12:67 . Ln. 48:00 . Di. 48:00 . Dr Tr	Berzelius	Do Wöhler		Do	Do Berzelius	Bussy .	Seftström Mosander			Kalus	H. Rose. Do	Svanberg
KH 25 B H H H H H H H H H H H H H H H H H H	266.82	420-20	ī	331.26	402.51	158.35	856.89	00-009	:	652-49	: :	own yet.
		33.62		26.50	32-20 59-59	12.67	68.55	48.00	:	62.11	: ::	Do.
36. Zirconum. 37. Aluminum. 37. Aluminum. 38. Glucinum. 40. Thorium. 41. Mannestum. 42. Vanadium. 43. Laythanum. 44. Didynum. 45. Errium. 47. Rutherium. 46. Terrium. 47. Rutherium. 48. Perlopum. 49. Normum. 50. Illemium.		Zr.		. GJ.	J.K	. Mg.	. Li	ŭ.	ë		AN P	Nr.
36. 38. 377. 377. 377. 377. 377. 377. 377.	Silicium.	Хисомим . Алемичм .		•	Уттвич . Тнович	MAGNESIUM.	VANADIUM . Lanthanum	Вирумич . Еврим	TERBIUM.	RUTHENIUM.	Ридорим . Мюном .	Nontra
	35.	36.		38.	39.	41.	43.	44.	46.	47.	8,0,0	51.

#### CHEMICAL.

#### SALTS.

Preparations and compounds of which Quicksilver forms the chief basis in Pharmacy, all these being recognised by the British Pharmacopæia—

#### HYDRARGYRUM (Quicksilver):-

Hydrargyri Iodidum Rubrum.

- " Viride.
- " Nitrates Liquor Acidus.
- " Oxidum Rubrum.
  - Subchloridum.
- .. Ammoniatum.
- .. Corrosivum Sublimatum.

Hydrargyrum cum Cretâ.

Pilula Hydrargyri.

Unguentum Hydrargyri.

- " Ammoniati.
- " Jodidi Rubri.
- ,, Nitratis.
- " Oxidi Rubri.

Preparations of which Bismuth forms the basis.— Bismuthum album, synonymous with Bismuthi nitras and Bismuthi subnitras, now prescribed largely by the faculty. Bismuth is often combined with lozenges.

#### Zinc forms the basis of the following Salts and Preparations:—

Zinci Acetas.

Zinci Oxidum.

- " Carbonas.
- , Suphas.
- . Chloridum.
- " Valerianas.

#### STRENGTH OF MATERIALS.

#### COHESIVE STRENGTH.

The cohesive strength of a body is that force by which its fibres or particles resist separation; therefore, the more particles there are in a body, the greater will be the power requisite to tear them asunder: hence, the strength of bodies is as the area of their cross sections.

Note.—The average breaking weight of a Bar of Wrought Iron, 1 inch square, is 25 tons: its elasticity is destroyed, however, by about two-fifths of that weight, or ten tons. It is extended, within the limits of its elasticity, 000096, or one-tenthousandth part of an inch for every ton of strain per square inch of sectional area.

Hence, the greatest constant load should never exceed one-fifth of its breaking weight, or 5 tons for every square inch of sectional area.

Column B, in the following Tables, gives the cohesive strength, in lbs., of the various bodies to which they refer.

#### General Properties of Metals. . Table 1.

	W	EIGHT	IN LB	s.		STRENGTH.			
Name of Metal.	Of a cube foot.	Of a plate 1 ft. sq. and 1 in. thick.	Of a bar 1 in. sq. and 1 ft. long.	Of a rod 1 in, in diam, and 1 ft. long.	Weight in Ibs. required to crush I square inch.	Weight in ibs. required to tear asunder 1 square inch.	Value of E.	Value of S.	Expansion in length for 1 degree of heat.
Cast Iron Wrought Iron Steel Copper (cast). Gun-metal Brass (yellow) Lead (cast) Zinc (cast)	450 475 490 549 510 523 710 439	40.5 40.8 45.7 42.5 43.6 59.3	3·33 3·40 3·81 3·54 3·63 4·94	2·45 2·61 2·67 2·99 2·78 2·85 3·88 2·40	(A.) 107,750 70,000  116,480  163,520 7,840	(B.) 17,920 58,952 130,000 19,072 35,840 17,958 1,824		890 196	*00000617 *00000698 *00000636 *00001430 *00001009 *00001044 *00001593 *00001634

#### General Properties of Timber. Table 2.

	1	IGHT N NDS.		STREE	SGTH.			ik.
Name of Wood.	Of a cube foot.	Of a bar I inch square and I foot long.	Weight in 1bs. required to crush I square inch.	Weight in lbs. required to tear asunder I sq. in.	Value of E.	Value of S.	Mean dlameter of the trunk,	Average length of the trunk,
Ash	48	•33	(A.)	(B.)	(E.)	(8.)	Ins. 23	FL 38
Beech	44	.30	8683	14,130	119.	2026	23	14
Chamana	55	.38		11,500 8,100	67	1556	37	44
Elm	35	.24	1284	9,740	50.64	1013	32	41
Fir, Mar Forest	44	.30		6,900	63.			ł
37 73 1	35	.24		10,210	158.5	1200		
Y)	47	.33	•••	9,500	90.	1102	20	75
Larch	34	.24	4920	12,240	76.	900	33	45
Mahogany, Honduras	35	24	1	11,475	115.3		3	
" Spanish .	53	-37	8198	7,560	65.5		72	40
N	36	.25	0130	8,320	105.47	1474	15	60
Oak, Adriatic	62	.43		12,830	70.5	1383		1
C 1'	55	.38		10,220	155.5	1766	34	53
The same	47	.33		12,720	86.2	1457		1
FE-L	58	.41	9509	11,880	105.	1672	32	42
Pine, pitch	41	-29		9,800	88.68	1632	1	1
2.3	41	.29	5748	11,840	133.	1341		
Sycamore	38	.26	7082	9,620	75.	1041	29	32
Teak	47	.32	1002	12,920	174.7	2462		

#### General Properties of Natural Stones. Table 3.

	1	GHT N NDS.		STRE	NGTH.		at of	Cos	trostr	TON.
Name of the Stone.	Of a cube foot.	Of a cube pard.	Weight in 1bs. on 1 sq. in. producing first fracture.	Weight in lbs. required to crush I square inch.	Weight in lbs, required to tear asunder I sq. in.	Weight of particles dis- integrated in grains.	Bulk of water absorbed, that the stone being 1.	Sillea, per cent.	Curbonate of lime, per cent.	Carbonate of magnesia,
Sandstone. Oolite Limestone Magnesian Limestone White marble Aberdeen Granite Welsh Slate	131 144 141 169 164	$\frac{3807}{4563}$	1491 1751 2733 4950	5219	(B.) 772 857  551	6·2 8·3 10·5 1·5	·097 ·155 ·114 ·148	5·0 1·7 1·1 Qu	1·1 93·8 83·9 54·6 94·5 artz,	4·2 40·6 0·0 Feld

#### TRANSVERSE STRENGTH OF BEAMS, BARS, &c.

If a beam be supported at both ends, and loaded in the middle, it will bend (which is called deflection); and if the load be increased, it will break (which is called fracture).-If a beam two inches deep and one inch broad support a given weight, another beam of the same depth, and double the breadth, will support double the weight; hence, beams of the same depth are to each other as their breadths :- again, if a beam two inches deep and one inch broad, support a given weight, another beam of four inches deep and one inch broad, will support four times the weight ;-hence, beams of equal breadths are to each other as the squares of their depths: -again, if a beam of a given cross section one foot long, support a known weight, another beam of the same cross section, but two feet long, will support only half the known weight ;-hence, beams of equal dimensions are to each other inversely as their lengths; therefore, the strength of beams is directly as their breadths and square of their depths, and inversely as their lengths; and if cylindrical, as the cubes of their diameters.

#### TRANSVERSE STRENGTH OF TIMBER.1

#### RECTANGULAR BEAMS.

#### PROBLEM I.

To find the ultimate Transverse Strength of any Rectangular Beam of Timber, fixed at one end and loaded at the other.

Rule.—Multiply the tabular value of S (see Table 2), by the breadth and square of the depth, both in inches, and divide that product by the length also in inches; the quotient will be the weight in lbs.<sup>2</sup>

Example I.—What weight will it require to break a beam of Fir, the breadth being 2 inches, depth 6 inches, and length 20 feet?

$$\frac{1100 \times 36 \times 2}{240} = 330 \text{ fbs.}$$

1 See Barlow's Essay on the Strength and Stress of Timber .- Art. 149.

<sup>2</sup> When the beam is loaded uniformly throughout its length, the same Rule will still apply, only the result must be doubled.

Example II.—What is the weight requisite to break a beam of Ash, 7 inches square, 3 feet from the wall?

$$\frac{2026 \times 7^3}{36} = 19,303\frac{19}{36} \text{ lbs.}$$

· Example III.—What will be the dimensions of a Fir beam .26 feet long, to support a weight of 400 tbs?

$$\frac{312 \times 400}{1100}$$
 = 113.5 the breadth and square of the depth.

Suppose the breadth to be  $2\frac{1}{2}$  inches, then  $\frac{113.5}{2.5} = 51.4$  the square of the depth, and  $\sqrt{51.4} = 7.17$  the depth.

Suppose the depth to be 8 inches, then  $8^2 = \frac{113.5}{64} = 1.77$  the breadth.

#### PROBLEM II.

To compute the ultimate Transverse Strength of any Rectangular Beam, when supported at both ends and loaded in the centre.

RULE.—Multiply the tabular value of S by the square of the depth in inches, and four times the breadth; divide that product by the length in inches, and the quotient will be the weight in ibs.

Example I.—What weight will break a beam of English Oak 7 inches broad, 9 inches deep, and 30 feet between the props?

$$\frac{1672 \times 81 \times 28}{360} = 10,534 \text{ lbs.}$$

Example II.—A beam of Beech, 7 inches deep, 4 inches broad, and 10 feet long, supports a weight of 4 tons; what additional weight will require to be added to break the beam?

$$\frac{1556 \times 49 \times 16}{120} = 10{,}165 - 8960 = 1205 \text{ lbs.}$$

Example III.—What will be the dimensions of a fir beam 30 feet long between the props, to support a weight of 6000 its?

 $\frac{6000 \times 360}{1100} = 1963.63 \text{ the square of the depth, and 4 times}$  the breadth.

Supposing the breadth 6 inches,

$$6 \times 4 = \frac{1963.63}{24} = 81.81$$
 square of the depth, and  $\sqrt{81.81}$  = 9.5 = depth.

Suppose the depth 10 inches,

$$10^2 = 100$$
, and  $\frac{1963 \cdot 63}{100 \times 4} = 4.90$  breadth.

Note 1.—When the beam is uniformly loaded throughout its length, the result must be doubled, i. e. it will support double the weight.

Note 2.—When the beam is fixed at both ends and loaded in the middle, one-half of the result must be added; and if the weight is laid uniformly along its length, the result must be tripled.

### DEFLECTION OF RECTANGULAR BEAMS OF TIMBER OB CAST IRON.

To ascertain the amount of Deflection of a uniform Beam, loaded in the middle and supported at both sides.

RULE.—Multiply the cube of the length in feet by the weight in its, and divide the product by 32 times the tabular value of E multiplied by the breadth and the cube of the depth, both in inches, and the quotient is the deflection in inches.

Example.—A beam of Ash 10 feet long, 8 inches deep, and 4 inches broad, and loaded with 4000 its. in the centre; what is the deflection?

$$10^3 = 1000 \times 4000 = 4,000,000.$$
  
E = 119 × 32 × 4 × 8<sup>3</sup> = 7,798,784, and 4,000,000 ÷ 7,798,784 = ·51 deflection.

To determine the Dimensions of a Rectangular Beam capable of supporting a required weight, with a given degree of deflection, when fixed at one end.

Rule.—Divide the weight to be supported in its. by the tabular value of E multiplied by the breadth and deflection, both

in inches; and the cube root of the quotient, multiplied by the length in feet, equals the depth required in inches.

Example.—A beam of Ash is intended to bear a load of 700 lbs. at its extremity, its length being 5 feet, its breadth 4 inches, and the deflection not to exceed \( \frac{1}{2} \) an inch.

Tabular value of E =  $119 \times 4 \times 5 = 238$ , the divisor; then  $700 + 238 = \sqrt[3]{2\cdot 94} \times 5 = 7\cdot 25$  inches, depth of the beam.

To find the Dimensions of a Beam capable of sustaining a given weight, with a given degree of deflection, when supported at both ends.

Rule.—Multiply the weight to be supported in its. by the cube of the length in feet; divide the product by 32 times the tabular value of E multiplied into the given deflection in inches, and the quotient is the breadth multiplied by the cube of the depth in inches.

Note 1.-When the beam is intended to be square, then the fourth root of the quotient is the breadth and depth required,

Note 2.—If the beam is to be cylindrical, multiply the quotient by 1.7, and the fourth root of the product is the diameter.

#### STATISTICS OF THE SCOTCH IRON TRADE.

Extracted, principally, from the Trade Circular issued by Thomas Thorburn, Esq., Glasgow.

#### PRODUCTION.

The make of Pig-Iron, in Great Britain, as nearly as could be arrived at, was as follows:—

		1	Furnac	es.	4	Tons.		Annual ge Product er Furnace Tons.	
In 1740		by	59			17,350		294	
1760		,,				22,000		•••	
1788		,,	85			68,000		800	
1796		"	121			125,000		1033	
1806		,,	169			250,000		1479	
1820		,,				400,000		•••	
1827		,,	284			690,000		2429	

#### SCOTLAND ALONE PRODUCED

In 1827		by	18		36,000			2000
1840		,,	64		241,000			3765
1845		,,	88		475,000			5397
1846		,,	98		570,000			5816
*1847		,,	100		510,000			5100
1848		,,	103		580,000			5631
1849		,,	112		690,000			6160
*1850		**	105		595,000			5666
1851		,,	112		760,000			6785
1852		,,,	113		775,000			6858
1853		,,	114		710,000			6228
1854		,,	117		770,000			6581
1855		,,	121		825,000			6818
1856		,,	126		832,000			6603
1857		79	129		448,000	to J	une :	30th.

In 1847 a strike took place among the miners, which lasted from July to September, and in 1850 from May to July.

#### 314 STATISTICS OF THE SCOTCH IRON TRADE.

The following Table shows the increase in this branch of the Iron industry in 1854, as compared with 1825:—

DISTRICTS.		f Iron rks.	Furn in B			Pig-Iron luced.
	1825.	1854.	1825.	1854.	1825.	1854.
Staffordshire	54	72	81	166	171,735	847.600
Shropshire	23	13	36	28	86,320	124,800
Yorkshire	14	14	22	21	35.308	73,444
Derbyshire	9	13	14	25	19.184	127.500
North Wales	9	7	8	9	13,100	32,900
South Wales	37	48	82	121	223,520	750,000
Northumberland, Durham, and North Yorkshire		23		59	•••	275,000
Cumberland and Lancashire.	13	2	2	3	3,000	20,000
Gloucestershire		4		5		21.99
Scotland	9	32	17	118	29,200	796,60
Total	168	228	262	555	581,367	3,069,83

The quantity of Iron ore required to make a ton of pig-Iron varies according to quality in the different counties: thus, for instance, in Northumberland and Durham, 4 tons is stated to be about the average proportion; in Yorkshire and Derbyshire, 3 to  $3\frac{1}{2}$  tons; and in Shropshire and Staffordshire, only 3 tons or less.

Mr. Kenyon Blackwell, in a Paper read before the Society of Arts in 1854, on 'The Iron Industry of Great Britain,' gives the following figures, which show the make of Iron in all countries for the previous year:—

								Tons.
								3,000,000
								750,000
								750,000
								300,000
								250,000
								200,000
								200,000
								150,000
an	States							100,000
es								300,000
	an	an States	an States .	an States				

6,000 000

By the above table the reader will observe that at his time England produced as much Iron as all the world besides.

# ENGLISH BLAST FURNACES AND ROLLING MILLS NORTH OF THE HUMBER.

From Griffith's 'Iron Trade Circular,' published March 1856. See Griffith's statistics, published in January 1861.

			FUBNA	WEEKLY PRODUCE.			
FIRM.	NAME OF WORKS.	In.	Ont.	Total.	Pigs.	Mallea Iron.	
		-			Tons,	Tons.	
(	Consett	- 5	2	7	600	450	
D	Crookhall	7	·	7	840		
Derwent Iron Company {	Bishopwearmouth.					400	
	Bradley	4		4	500		
Bolckow & Vaughan .	Witton Park	4		4	600	300	
Ditto	Middlesbro'	3		3	450	300	
Ditto	Eston	6		6	900		
Ditto (Elwyn & Co.) .	Eston	3		3	430		
Bell Brothers	Clarence	3		3	400		
Ditto	Felling	2		2	260		
Ditto	Wylam	1		ī	120		
Losh, Wilson, & Bell .	Walker.	4	1	5	560	300	
John Carr & Co	Tyne Main	2	l	2	240		
Weardale Iron Company.	Tow Law	4	2	6	500		
Ditto	Stanhope		1	1	,,,,		
Ditto	Tudhoe		1			300	
James Wakinshaw .	Monkwearmouth .				:::	60	
Hawks, Crawshay, & Sons	Gateshead					250	
Tyne Iron Company.	Leamington	2	1	2	200	40	
Hareshaw Iron Company,	Hareshaw		3	3	200		
Bedlington Iron Company	Bedlington		2	2			
Birtley Iron Company .	Birtley	2	1	3	200	60	
Gilkes, Wilson, & Co.	Middlesbro'	4		4	500		
Cochrane & Co.	Ormsby	2	2	4	250		
B. Samuelson & Co.	Eston	3	1	3	400	1	
South Stockton Iron Co.	Caralia	3	•••	3	400		
South Durham Iron Co	Darlington	2	•••	2	240		
Snowdon & Hopkins .	30:331	_		_	240	200	
West Hartlepool Iron Co.	West Hartlepool .		3	2			
	Total	66	17	83	8590	2660	

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COLOBNE 1865, BOLD MEDAL.



DUDLEY 1866, MEDAL.
PARIS 1867, MEDAL.
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HAVRE 1868, DIPLOME D'HONNEUR

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We have used Messrs. Colley's Screws and Boxes in our rolling mills for some time, and so far as we have had an opportunity of proving them, we consider them well manufactured, and they appear to stand ther work properly.

'JOHN BAGNALL & SONS.

'Gold's Hill Iron Works: 'January 22, 1839.'

'To Messrs. Colley & Co.
'Hope Works, West Bromwich.

'Staffordshire Iron Works: April 10, 1862.

'The Screws and Boxes supplied by you for our large Plate Mill are evidently well cut, made of the best material, and work well. We have never had to replace any Screws of yours through breakages. The 30-ton Jack you supplied us with is a good specimen of your lifting machinery. Mr. Joseph Mills, our engineer-in-chief. tells us your Jacks are the best made. We require a smaller Jack. Call to-morrow morning, and Mr. Danks will instruct you in respect to the order.

'We remain, yours respectfully,

'Per E. B. THORNEYCROFT & CO.
'EDWARD BENJAMIN THORNEYCROFT.'

'Factory Iron Works, Tipton: 'January 27, 1849.

'This is to certify that Messrs. Colley have supplied us with Holster Pins and Boxes for our mills, and we find them to be of first-rate workmanship and quality. 'WELCH, BARROWS, & CO.'

#### TESTIMONIALS-continued.

' Highfields Foundry and Wrought Iron Works,

'Bilston: November 1850.

'We have for some time purchased Screws and Boxes from Messrs. Colley, which have given us every satisfaction as to their quality and workmanship.

'THOMAS PERRY & SONS.'

'Garndyrriss Iron Works, near Abergavenny, 'June 19, 1850.

'This is to certify we have used Messrs. Colley's Screws and Boxes in our rolling mills for some time, and which have turned out to our satisfaction; in fact, they are the best we have ever had in our works.

Per Pro. THE BLÆNAVON IRON AND COAL COMPANY.

'THOMAS HEMMING.'

Messrs, Colley.

Brierley Hill: July 15, 1858.

'Gentlemen,-We have had one of your 25-ton Lifting Jacks in use for the last nine months, and we have found it to be quite what you represented.

'We are, yours respectfully,

THE NEW BRITISH IRON COMPANY.

'Per H. M. SIMINCOURT.'

' Park Gate Iron Works, Rotherham: ' April 6, 1858.

'Gentlemen,-We have had in constant use one of your 25-ton Lifting Jacks for the last three years, which has given us great satisfaction. We have never had a Jack at our Works that has done its work so safe as the above, of your make.

' Yours truly.

For SAMUEL BEALE & CO.

'Messrs. Colley.'

GEORGE S. SANDERSON.

'Freeth Street, Birmingham: Oct. 10, 1867. 'Gentlemen-In reply to your inquiry as to "how the Pins and Boxes in our Roll Frames wear," we have examined them and find that some which have been at work twelve, and others fifteen years, are still in excellent condition, and will probably last yet a further five years. We should state we always work the Pins quite dry. You may use this letter in any way you please.

' Yours truly,

· THOS. WHITFIELD & CO.

'Messrs. Colley & Co. ' West Bromwich.'

' Avon Vale Tin Plate Works.

'Messrs. Colley & Co.

'Aberavon, Glamorganshire: May 19, 1866.

'Dear Sirs,-In reply to yours of the 15th instant, we have let the Screws and Boxes to the Contractors for our Machinery. I shall name your Firm to them and shall have great pleasure in doing so, as your Screws and Boxes gave us satisfaction for many years (in the time of the late Wm. Llavidyn & Sons).

' Yours truly,

'THE PORT TALBOT TIN PLATE CO.

'Per THOS. JENKINS.'

#### TESTIMONIALS-continued.

'Bilbao,	Spain:	May	26,	1868
----------	--------	-----	-----	------

'Messrs. Colley & Co.

West Bromwich.

Dear Sirs,—We are favoured with yours of the 18th instant, and in reply to say that we are not short of any Wrought Iron Pins or Boxes for the present Neither can we send you an order for the Lifting Jacks, as we are pretty well supplie with the two or three we have in use. Should we require any more of these we shall bear you in mind. We are glad to state that the Wrought Iron 1 Boxes that you supplied us in June 1866 have given us satisfaction, and remultiple of the same state of the same state of the same shall be are you supplied us in June 1866 have given us satisfaction, and remultiple of the same same satisfaction.

'Yours truly.

'YBARRA & CO.'

'Eagle Iron Works, West Brom 'July 7, 1849.

'I have used Messrs. Colley's Screws and Boxes in my rolling mills: time, and so far as I have had an opportunity of proving them, I consider the manufactured, and they appear to stand their work properly.

'JOHN HARTLAND,

Per JOHN HARTLAND,

'The Tividale Iron Company, Tividale Iron W 'Near Tipton: June 10, 1850.

'Messrs. Colley have supplied us with Pins and Boxes, the quality c has turned out to our satisfaction.

'THE TIVIDALE IRON CC

'Pontypool,

'Messrs. Colley,

'Gentlemen,—I am glad to be able to say that the 30-ton Lifting J sent us does its work well.

'Yours obediently, 'W. WILLI

'Newport, Monmouthshire: 'Oct. 31, 1855.'

> 'Pontymister Works, near Newpor 'Monmouthshire: March 7,

' Messrs. Colley,

' Hope Works, West Bromwich,

Gentlemen,—We have just received the Lifting Jack, which gives sati we enclose our cheque, £15, for which please send receipt. We are not in we of any Pins and Boxes at present. You did not answer our inquiry about Cr Winches.

'Messrs, BANKS & CO.'

#### TESTIMONIALS-continued.

	'Tivid	ale Iron and Tin Plate Works,
Messrs. Coll	ATT	'Near Tipton: April 21, 1858.
'Gentlemer		ton Lifting Jacks in constant use at ng it is in every respect quite equal to
our representation		'Yours truly,
ri in A	Vest Bromwich.'	'BUDD & CO.
	'Pontyr	nister Works, near Newport, 'Monmouthshire: May 3, 1860.
1x1x, 315		instant, but at present are not in want have had from you have always given Il write you.
x 1111 etc	'Yo	ours respectfully,
र रासा हुन्द्र		BANKS & CO.
, 1 od	Bills & Mills.	
FC. 6_	een using for some time Bo	xes and Pins which prove to be very Colley, West Bromwich.
•		'P. W. BOOTH.
0	n Iron Works:	
o	. 1849.'	
		Iay Colliery and Iron Works, West Bromwich: November 1849.
		have used for nine years the Wrough Colley, and have found them to answe
		'THOMAS DAVIES & SONS.'

'Pontier Caerleon Tin Works: May 17, 1862. ertify that we have used Messrs. Colley's Pillars and Boxes for during that time we have not broken one; in fact, they are as good ut them up; and we have no hesitation in saying that they are the

> 'For JOHN JENKINS & CO. ' EDWARD FRANCIS.'

'Tividale Iron and Tin Plate Works,

get to answer our purpose.

'Tipton: Oct. 11, 1867. · we nave ... some years used the Pins and Boxes manufactured by Messrs. Colley & Co., and can testify to their very good quality; they are the best we can

> 'BUDD & CO. 'Per W. H. JONES.'

# W. T. HOLLAND,

## YNISYMUDW, near SWANSEA,

MANUFACTURER OF

# SOUTH WALES 'DINAS' (OR SILICA), 'PONT',

AND OTHER

## FIRE-BRICKS,

FOR HIGH HEATS; ALSO

# FIRE-PROOF CLAY & CEMENTS,

As used for Steel, Copper, Iron Furnaces, &c.

'Dinas' Bricks have been made at the Ynisymudw Works upwards of thirty years, chiefly for works in the locality, and the quality is well known in the Swansca Valley district. These 'Dinas' will stand cooling well, and suit for roofs of Puddling Furnaces; the size is large, and they bear carriage and transhipment with little breakage. Prices shipped f. o. b. in North Dock, Swansca; or loaded into Railway trucks at Ystalyfera or Swansca Stations.

The best quality of 'Dinas' warranted to stand the intense heat of Siemen's Patent Regenerative Gas Furnaces for Steelworks &c.

> Y W DINAS

TRADE MARKS.

Y W PONT

POSTAL ADDRESS:

## W. T. HOLLAND.

LLANELLY.

CARMARTHENSHIRE.

# CLARIDGE, NORTH, & CO.

Phanix Foundry & Engineering Works, BILSTON, STAFFORDSHIRE,

MAKERS OF EVERY DESCRIPTION OF

MACHINERY AND PLANT FOR IRON & STEEL MANUFACTURE.

CHILLED AND GRAIN ROLLS.

Reversing Gear. Tyre Mills.

IMPROVED DIRECT-ACTING

SLOWING & PUMPING ENGINES.

MILL AND FORGE CASTINGS.

'HEELS MOULDED BY PATENT MACHINERY.

GAS AND WATER PIPES.

GENERAL CASTINGS.

# LEE & BOLTON, HYDE IRON WORKS.

#### NEAR STOURBRIDGE.

TELEGRAPH OFFICE, KINVER.

						L	&	В.	L. &	В. 1	BEST	L. &	В.	BEST
						Pe	r T	on	Pe	er T	on	Pe	r T	on
Half-l	t Bars, incl Rounds above and Squares,	l in. wid	le	and.	1}	£	0	d. 0	£ 15	<b>8.</b> 0	<b>d</b> .	£ 17		d. 0
Ditto	ditto	3 in.				14	10	0	15	10	0	17	10	0
Ditto	ditto	5 in.				15	0	0	16	0	0	18	0	0
Ditto	ditto	1 in.				15	10	0	16	10	0	18	10	0
Ditto	ditto	No. 4	W.G			16	0	0	17	0	0	19	0	0
Ditto	ditto	No. 5	,,			16	10	0	17	10	0	19	10	0
Ditto	ditto	No. 6	,,			17	0	0	18	0	0	20	0	0
Boiler P	lates, not exc	eeding 3	cwt.	eac	h .									
Ditto	ditto	3	,,	,,					1					
Ditto	ditto	4	**	**										
Sheet Ir	on Singles, to	No. 20	W.G.						ì					
Ditto	Doubles,	21 to 24	**											
Ditto	Trebles, 2	5 to 27	,,											
Slit Rod	s and Angle	Iron		•				•••	15	0	0	17	0	0

Flats, under Inch by 4, and best Half-Rounds and Best Ovals, not above Inch wide, charged as Small Squares.

Round, Taper, Irregular-shaped, or Extra Long Plates or Sheets, 20s. per ton extra-

PLATING.	£16 and	LEE BEST	& E	PLATING.	£17 and
I wo de	Harman I				

BEST BEST PLATING, £19 per ton, Warranted.

Iron Stamped, BEST NUT, BEST RIVET, and BEST CABLE, Warranted.

Bars up to 3 in. round, and Small and 6 in. Flats.

## VIENNA EXHIBITION 'MEDAL FOR PROGRESS.'

# TANGYE BROTHERS & HOLMAN,

LONDON. E.C.

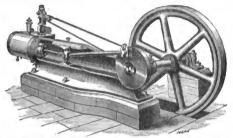
TANGYE'S NEWLY - DESIGNED HORIZONTAL HIGH-PRESSURE

# EXPANSIVE STEAM ENGINES,

WITH

TANGYE'S PATENT HIGH-SPEED GOVERNOR.

The Design, Workmanship, and Low Price of these Engines have called forth universal admiration, and upwards of 800 of them have been sold since their ntroduction in December 1869.



In this Engine the working parts are considerably reduced in number, as compared with Horizontal Engines generally, rendering it far more durable and compact. The bed-plate, front cylinder cover, cross-head guides, and plummer-block for crank-shaft bearing, are all cast in one piece, the cylinder with its valve-chest being bolted to the end of the bed. The cross-head slippers and connecting-rod ends are made adjustable, so that any wear can be readily taken up. The fly-wheel, cylinder-end, connecting-rod, and crank-plate, are all bright. All the parts are made to Whitworth's Gauges, and the material and workmanship are of the highest class throughout.

SIZE Nominal Horse Power Indicated Horse Power	B TWO. 3.8	C THREE. 5.9	D FOUR. 8.6	81X. 15.0	G EIGHT. 19:4	H TEN. 23.9	J TWELVE 34.5
PRICE OF ENGINEEXTRA	£32	£38 15 £3, 15	£46	£70 £5. 10	£90	£115 £7.10	£135

Prices of Boilers for above on application.

## THE 'SPECIAL'

# DIRECT-ACTING STEAM PUMP.

Adapted for all purposes of Pumping.

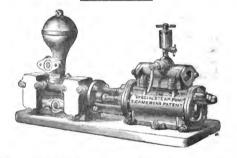
OVER 3,000 OF THESE PUMPS HAVE BEEN SOLD BY

#### MESSRS. TANGYE

Since their introduction in 1867, representing 25,000 Horse-power, and greatly exceeding the number made by all the rest of the Horizontal Direct-Acting Steam

Pump Makers in this Country put together.

## VIENNA EXHIBITION, THE GRAND PRIZE MEDAL.



Requires no Shafting, Gearing, Riggers, or Belts.

Works at any Speed and any Pressure of Steam. Will Force to any Height. Delivers a Constant Stream.

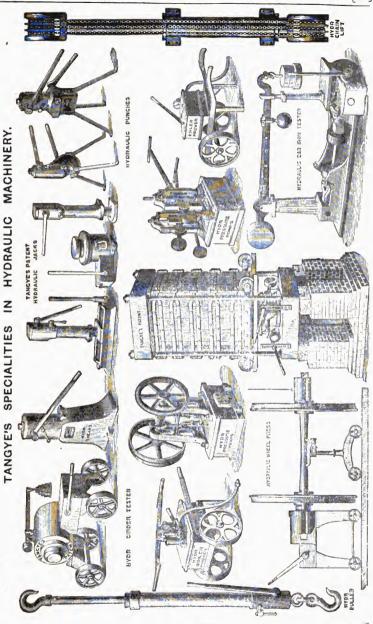
Can be placed at any distance away from a Boiler.

Can be placed at any distance away from a Boiler.

Occupies Little Space.

SIMPLE. DURABLE. ECONOMICAL.

Two Hundred sizes, and combinations of these Pumps are now made in all sizes from 24 in. to 32 in. diameter, Steam Cylinder; 14 in. to 14 in. diameter, Water Cylinders; and 6 in. to 6 ft. stroke, to throw any quantity from 500 to 50,000 gallons per hour, and any height up to 1,200 feet.



VIENNA EXHIBITION, GRAND PRIZE MEDAL FOR PROGRESS.'

# HOLMAN LAURENCE TANGYE

MACHINES HAND-POWER IMPROVED TANGYE'S

# JAMES WADHAM, SENR. & CO.

# METAL & MACHINERY BROKERS;

AND GENERAL COMMISSION MERCHANTS,

#### DARLINGTON.

Agents for

W. I. GAS, STEAM, WATER, & BOILER TUBES & FITTINGS.

Manufactured by Richard II. Taunton and Hayward, W. I. Tubing of all descriptions. Also Peet Valees, Tuyere Coils, Core Bars, &c.

PATENT PROPHYLACTIC COMPOUND,

For preventing and removing Incrustation in Boilers.

PIG IRON.

Cleveland, Hamalite, Scotch, Stafordshire.

PLATES.

Ship and Boiler qualities, Also Mallet's Buckled Plates.

SHEETS.

For ordinary purposes or for Corrugation.

RAILS.

New and Second-hand, all

RAILWAY

Spiles, Switches, and Crossings, &c.

ANGLES, TEES,
CHANNELIRON,BEAMIRON,
RIVET IRON, RIVETS,
BOLTS AND NUTS,
CHILLED & GRAIN ROLLS,
ETC.

BAR IRON.

Rounds, Flats, Squares, Convex, &c.

BRASS CASTINGS.

MONTHLY LIST

OF

NEW AND SECOND-HAND

ENGINEERING,

SHIPBUILDING,

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Plant & Machinery,

FOR SALE

BY PRIVATE CONTRACT,

FORWARDED FREE

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APPLICATION.
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Agents for

BEST OOLITE LIMESTONE,

Supplied by The New Bridge Lime Co. Price&Analyses on application.

PATENT STONE BREAKERS.

Adapted for crushing the hardest materials, breaking them into cubical and uniform pieces.

NEW MACHINERY and TOOLS

Of all descriptions used in Irontcorks, Collieries, Shipyards, and Engineering Shops. Brickmakers' Plant and Grinding Machinery.

> LOCOMOTIVES and

PORTABLE ENGINES
New and Second-hand.

STEAM PUMPS.

And Hand Pumps of all kinds.
CRANES. TURNTABLES,
WEIGHING MACHINES,
RAILWAY WAGGONS,
PATENT HYDRAULIC
LIFTING JACKS,
MORTAR MILLS,
FRIEDMANN'S INJECTORS
AND ELEVATORS

WROUGHT & CAST

BRIDGEWORK.

# PARIS

# UNIVERSAL EXPOSITION,

1867.





# THE GOLD MEDAL

WAS AWARDED TO

# THE BARROW

# HÆMATITE STEEL COMPANY, LIMITED,

\_....,

For Excellence in Steel Manufactures.

# THE BARROW

# Næmatite Steel Company,

LIMITED,

Manufacture

STEEL RAILS, WELDLESS TYRES,

AXLES,

PLATES FOR SHIPBUILDING BOILERS,

GIRDERS, BRIDGES,

ROOFS, BARS,

ANGLES, GUNS, AND FORGINGS,

OF EVERY DESCRIPTION.

IN STEEL:

And, in addition, supply the

## HÆMATITE ORE AND PIG IRON

From which the Steel is exclusively made.

# BARROW

# Næmatite Steel Company,

LIMITED.

#### CAPITAL ONE MILLION.

CHIEF OFFICES AND WORKS:

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DEPOT-MONUMENT LANE STATION,
LONDON AND NORTH WESTERN RAILWAY WHARF.

TRADE MARKS.



NE PLUS ULTRA.
H.L.M.
BRADLEY BRIDGE CHARCOAL.

STEEL.
PIG IRON.
BAR IRON.
HOOP IRON.
STRIP IRON.
BOILER PLATES.
SHIP PLATES.
TANK PLATES.
IRON RAILS.
STEEL RAILS.
BOLTS. NUTS.
SPIKES.
IRON ORES.
COKES.

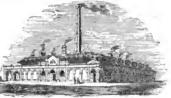
BRADLEY BRIDGE CHARCOAL, MALLEABLE, & BESSEMER PIG IRON CO.

OFFICES :-

1 TEMPLE ROW WEST, BIRMINGHAM.

SOLID

FND



TOWER

BOLTS.

Albion Works, WILLENHALL:

March 5, 1873.

DEAR SIR,

In consequence of the continued advance of Iron, Coal, Coke, &c.

We are reluctantly compelled to reduce our discount for Tower and other Bolts 5 per
Cent. from this date, and a corresponding advance on those goods usually charged set.

Soliciting your commands, which shall always have our best attention,

We remain your obedient Servants,

JOHN HARPER & CO.

#### DISCOUNTS.

No	. 9	(or 59) Solid End	Tower Bolts	52½%
,,	8	(or 55)		50%
,,	7	(or 100) "		40%
,,	8	Brass Knob, Solid	End Barrel, 2d.	per inch50%
		Patent Barrel		,,35%

MANUFACTURERS OF

# DOOR BOLTS, SUITABLE FOR EVERY MARKET, Both Home and Foreign:

Patentees and Manufacturers of Rim and Mortice Locks, Latches, Lock Furniture, &c. &c.

JAPANNED STOVE SHOVELS,
JAPANNED D HANDLES FOR SPADES, ETC.

Registered Thumb, Norfolk, Suffolk, and Anglo-American Gate Latches;

#### PATENT HUNTING GATE LATCHES;

SIGNAL PULLEYS FOR RAILWAY PURPOSES;

SASH FRAME AND AXLE PULLEYS, DOOR KNOCKERS, KNOBS, AND BUTTONS;

Japanned Ironfoundry and General Hardware.

Malleable Iron Castings made to any Pattern for Telegraphs, Agricultural Implements, or other purposes.

#### Albion Works, WILLENHALL (Wolverhampton):

JULY 3, 1872.

BY ROYAL LETTERS PATENT



GREAT BRITAIN, FRANCE, AND BELGIUM.

DEAR SIRS.

We take the liberty of again calling your attention to our newly-discovered Oxide, for the annealing of Malleable Iron Castings (Tildesley's Patent Compound). Since forwarding you our Circular of February 6th, it has been very satisfactorily adopted both at home and abroad. At home, while some have only in part adopted its use (mixing it with the Red ore), others, both in Staffordshire, Yorkshire, Lancashire, and Monmouthshire, have entirely abandoned the use of Hæmatite ore, and they assure us that our Oxide is far preferable. Abroad, we have a depôt both in France and Belgium, and we are well satisfied with the sales we have made in those Countries.

When you take into account the present price of Hæmatite ores you will at once see that ours, apart from its superior strength, has the advantage.

Any explanation we can make, or instructions we can give, will be rendered with pleasure.

We may here state that we have ourselves Seven Annealing Ovens in constant use, and now for nearly a year our Oxide alone has been used.

Soliciting your commands, direct or through our Agents,

We are, Sirs,

Your obedient Servants.

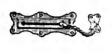
#### JOHN HARPER & CO.

 DC ODGGIL	- Jan 1	mine parp	or and the control of
Messrs.	THOMAS (	COX & CO	BIRMINGHAM.
Messrs.	G. & W. T	INDERHILL	WOLVERHAMPTON.
Messrs.	CARRICK	& BRICKBANI	Clarence Street, MANCHESTER.

To be obtained only for Annealing nurrosus at these Works or through our Agents :-







# MALLEABLE IRON CASTINGS.

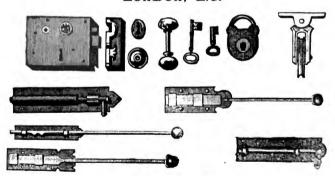
# JOHN HARPER & CO.

IRONFOUNDERS, ETC.

ALBION WORKS,

WILLENHALL, STAFFORDSHIRE;

54½ BISHOPSGATE STREET WITHIN, LONDON. E.C.



ANUFACTURERS OF

# LOCKS, LATCHES, AND DOOR BOLTS:

Axle Pulleys, Door Knockers, Galvanized Signal Pulleys.

STAMPED, PRESSED, AND FORGED IRON WORK.

#### MALLEABLE IRON CASTINGS.

OF ALL DESCRIPTIONS.

PARTICULARLY FOR TELEGRAPHIC PURPOSES.

# JOHN HARPER

MALLEABLE FOUNDRY,

> ALBION WORKS.

WILLENHALL. SOUTH STAFFORDSHIRE.

MANUFACTURERS OF



SUITABLE FOR EVERY MARKET, BOTH HOME & FOREIGN; PATENTERS AND MANUFACTURERS OF

## RIM AND MORTICE LOCKS, LATCHES, LOCK FURNITURE. ETC.

JAPANNED STOVE SHOVELS,

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Registered Thumb, Norfolk, Suffolk, and Anglo-American Gate Latches :

PATENT HUNTING GATE LATCHES: SIGNAL PULLEYS FOR RAILWAY PURPOSES:

# SASH FRAME & AXI

DOOR KNOCKERS, KNOBS, AND BUTTONS:

JAPANNED IRONFOUNDRY AND GENERAL HARDWARE:



Malleable Iron Castings made to any pattern for Telegraphs, Agricultural Implements, or other purposes.

Patentees of Smoke-preventing Furnace, applicable to Steam Boilers. Vut and Bolt Makers' Furnaces, consuming small Slack instead of Coal, and well adapted for Potters' Clay Boiling Houses.

'atentees for the application of certain known materials to be used in the Annealing of Cast Iron to produce Malleable Iron Castings.

# LANDER & LARSSON,

15A NEWHALL HILL, BIRMINGHAM.

## IMPORTERS

OF ALL KINDS OF

# SWEDISH CHARCOAL IRON,

VIZ.

## PIG IRON

FOR THE BESSEMER PROCESS.

# PUDDLING, STRONG CASTINGS, AND MALLEABLE CASTINGS.

SPIEGELEISEN, containing 10 per cent. to 16 per cent. of Manganese.

HAMMERED AND ROLLED IRON OF ALL SIZES.

NAIL RODS, WIRE RODS, HOOPS, SHEETS, BOILER PLATES, ANGLE IRON, TYRES, RAILS, &c.

KEG AND FAGGOT STEEL.

Superior Quality of Swedish Charcoal Wire Rods, especially made for Rope Wire and fine Wire.

AGENTS FOR MOTALA IRON WORKS, SWEDEN.
For England and the Continent.

Manufacturers of Bessemer Boiler Plates, Tyre Bars, Axles, Bar Iron, Rivet Iron, Forgings, &c.



# SULPHINE.



SOLE MANUFACTURERS.

# WILLIAM BAILEY & SON.

HORSLEY FIELDS CHEMICAL WORKS, WOLVERHAMPTON,

2 and 3 Abchurch Yard, Cannon Street, London, E.C.

SULPHINE is the most important discovery in Medicine that has been made for many years. It is a clear and colourless liquid, possessing very remarkable therapeutical properties.

SULPHINE strikes at the root of numerous diseases, by destroying the germs which enter the system along with the food we eat, the beverages we drink, and the

air we breathe.

SULPHINE purifies the blood from these sources of disease, by destroying the germs, or animated cells, which are carried by the circulation to every part of the system, and which propagate with amazing rapidity: it renders all the secretions healthy.

SULPHINE also stops fermentation and prevents putrefaction: It is a powerful disinfectant, and arrests the progress of all epidemics and contagious disorders. It is intagonistic to cholera, typhus, measles, scarlet fever and small pox, and all Zymotic

liseases.

SULPHINE, by regulating the fermentation of food in the digestive organs, is in immediate cure for flatulence and indigestion. It is a specific for chronic dyspepsia, and strikes at the root of all those evils which follow in its train—headache, heart-num, nausea, constipation, debility, &c. By this action it allows time for the food to ecome properly dissolved by the gastric juice.

SULPHINE, applied externally by means of a rag or sponge, is a remedy for such

liseases of the skin as have their origin in the microscopic germs of organic life.

SULPHINE, used as a gargle, cleanses the mouth, sweetens the breath, and revents decay of the teeth and tenderness of the gums.

SULPHINE, introduced into the throat by means of W. Bailey & Son's Sprayroducer, relieves sore throat and bronchial affections.

SULPHINE has no disagreeable taste, nor has it any unpleasant action upon the owels. It may be taken with perfect safety by persons of all ages and sexes, and in, in no instance, be productive of harm.

#### Price 1s. and 2s. per Bottle.

ztract from Letter of M. THOMAS SUTTON, B.A. Cantab:- 'It gives me much pleasure to be able to testify to the merits of SULPHINE as a cure for indigestion. I had been for three years a martyr to that complaint."

om Frère Arnouldt, of Rodon, France :- Your SULPHINE has, after a few days, freed me from all painful sensations, and I certainly regained my strength as by

enchantment.'

Numerous other Testimonials on application.

#### INDIGESTION CURED BY SULPHINE."

Price 2d. By Post, 3d.

W. PARKE, High Street, Wolverhampton.

#### xxviii

## BEANES' PATENT BREWING MATERIAL

AMONA THE MOST PROMINENT ADVANTAGES DERIVED FROM ITS USE MAY RE NOTED THE FOIL OWING :-

It enables the operation of Brewing to be conducted with certainty and success at all times and It enables the operation of Brewing to be conducted with certainty and success at all times as seasons. It may be used in the preparation of every description of Malt Liquor. It reades Ale, Stout, and Porter permanently sound, without decreasing their 'body' or imparing the flavour. It removes from Beer those substances which cause the alcoholic fermention to pass into the acctous. It causes more rapid and complete extraction of the active ingredients of the Mill is particularly adapted for Pale and India Ales. It prevents undue coloration when 'stained malt' is need. It causes the yeast to 'gather' more perfectly.

MATERIAL' is inexpensive in itself, and occasions a considerable saving in both time and labor.

as well as in the malt used.

Sole Licensees and Manufacturers, WILLIAM BAILEY & SON, Horsley Fields Chemical Works, Wolverhampton.

#### UNIVERSAL BAILEY'S

OF GREAT STRENGTH AND ABSOLUTE PURITY.

APPROVED BY HER MAJESTY'S HONOURABLE BOARD OF INLAND REVENUE.

Impart to Ale, Stout, Porter, Cooper, as well as to Wines, Cider, Perry, and all other Fermented Liquids, perfect clearness and brilliancy.

Are absolutely free from all deleterious substances, no acetic, lactic, or other

injurious organic acids being contained therein.

Convert thick, muddy, unsound, and unsaleable Beer into a limpid, bright, wellflavoured, saleable beverage with unexampled rapidity.

By their wonderful preservative properties enable Brewers to keep even the cheaper kinds of Malt Liquor in stock without risk of deterioration.

Prevent all undue secondary fermentation, and keep all kinds of Beer sound and

free from acidity in any climate, thus effecting a considerable saving. Contain no portion of impure or unwholesome gelatine, derived from bones, hoofs,

hides, &c., such as is frequently used in the manufacture of so-called 'Finings.'

Preserve and improve all sound Malt Liquors, restore all those in unseed condition to their pristine brilliancy and flavour, obviate mustiness, and prevent loss

Are the result of lengthened scientific researches, are approved by the principal Brewers of the United Kingdom, and are guaranteed to contain none but the purs ingredients.

> Price 3s. per Gallon, with full directions for use. SPECIAL TERMS FOR LARGE QUANTITIES.

Sole Manufacturers-Messrs. WILLIAM BAILEY & SON, Horsley Fields Chemia Works, Wolverhampton, and at 2 & 3 Abchurch Yard, Cannon Street, London, El.

#### BAILEY'S CONCENTRATED FLUID MAGNESIA.

Prepared with great care and strongly recommended by the Faculty, for removing I Acidities, and Indigestion, restoring appetite, preserving a regular action of bowels, and dissolving uric acid in Gravel and Gout; also as an easy remedite Sea Sickness, and for all the febrile affections incident to childhood it is invaluable moreover, it is especially valuable as a specific for Heartburn and Spasm. On a value of Magnesia as a remedial Agent it is unnecessary to enlarge; but this F.s. Preparation is the most valued by the profession, as it entirely avoids the possible of those dangerous concretions usually resulting from the use of the article in power

#### PREPARED BY WILLIAM BAILEY & SON, HORSELEY FIELDS CHEMICAL WORKS, WOLVERHAMPTOR In Bottles, 1s. and 2s. 6d. each.

Particularly adapted for Exportation, as it will keep good for any length of time, and in ever climate; also put up in half-gailon and gailon bottles, for the use of Hospitals, Dispensaries, and Compounding Frescriptions, at 5s. and 9s. each.

The Acidulated Syrup, for use in conjunction with the Fluid Magnesia In bottles, 1s. each.

# MEDLOCK & BAILEY'S PATENT BISULPHITE OF LIME,

PRESERVATION OF MEAT, FISH, POULTRY, GAME,

And all other Animal Substances, in Temperate or Tropical Climates, and on board Ship.

By the use of this valuable Preparation, fresh meat can be had throughout a voyage, however long, thus avoiding the expenses and losses incidental to the conveyance of lire stock on board. No steamer or passenger ship should be without it, as it will enable captains to lay in provisions at foreign ports, wherever they are cheap and good, relieving them of the necessity of providing for the voyage home. It imparts no flavour to the meat, nor does it lessen its nutritive value, while it prevents scurvy and destroys contagion wherever it is used. For further particulars, see Descriptive Pamphlet, sent post-free for seven stamps.

Extract from a Letter received from Sir James Matheson, Bart., M.P., dated 26th July, 1868, enclosing a further order: - Sir James Matheson is glad to tell Messrs. William Bailey & Son that their Bisulphite of Lime answered perfectly in carrying the carcases of a deer and a calf from Stornoway to London quite fresh, being on the journey and voyage four days, during the very hot days of June; besides enabling the venison and veal to be kept for twelve days after arrival, by using the Bisulphite according to directions.'

Thomas J. Hutchinson, Esq., F.R.G.S., F.A.S.L., &c., &c., Her Britannic Majesty's Consul for Rosario, Rio de la Plata, writes:— When at Monte Video, I had the pleasure of tasting at breakfast a small piece of beef prepared by the Bisulphite of Lime, and sent out to the Plate. It was given to me by Mr. Prange. The preservation of that meat was perfect, and it was the first piece of real juicy beef that I had tasted

for the last seven years.'
Dr. Stone, Health Officer, Trinidad, writes:—'I have found your Bisulphite of Lime of great value as a means of preserving meat.

The Governor of the City Poor House, Edinburgh, is 'very highly pleased with the esults obtained from the use of your Bisulphite.

Extract from the Analytical Report of Wentworth L. Scott, Esq., F.C.S., &c. :- 'The afest, simplest, and most effective means for the "preservation of animal substances" hat has yet been brought before the public.'

Mr. J. W. Salisbury, Meat Salesman, of Newgate Market, London, writes to the

Patentees: — It is a most valuable thing for butchers!

Mr. George Blackman, Butcher, of Newport Market, London, writes:— I find Medlock and Bailey's Patent Preserving Liquid invaluable. Mr. George Scarlett, Butcher, of Notting Hill, London, writes:—'I believe there is othing to be compared with your Bisulphite.'

Mr. Alexander McAllister, Fish and Game Salesman, of Glasgow, states :- By

our Patent Process I have succeeded quite beyond my most sanguine expectations.' Messrs. Hoper & Schwerin, of Berlin, Sept. 17, 1868 :- 'We have much pleasure in nforming you to-day that our success with meat as well as beer has been complete evond expectation.

In addition to its remarkable powers in preserving animal substances from decay, Medicak kaller's Bisulphate of Lime is also an absolute specific against epidemic Cattle Disease if used in coordance with the Patentee's Instructions. It thus enables the Shipper to carry either 'live or end' meat in perfection without fear of loss in transit from the bad health of the one or the scomposition of the other.

Sole Manufacturers-Messrs. WILLIAM BAILEY & SON, Horseley Fields Chemical Works, Wolverhampton;

And 2 and 3 Abchurch Yard, Cannon Street, London, E.C. The GENUINE Bisulphate of Lime of Medlock & Bailey ONLY should be used.

Price 3s. 6d. per Gallon, Packages included. Pure Chemicals of every description, for Medical, Photographic, and Scientific purposes.

By Ber Majesty's



Royal Zetters Patent.

#### STANLEY'S

#### PATENT FURNACE,

FOR

SMELTING ORE

OR

RE-MELTING IRON OR OTHER METAL.

#### PUDDLING

AND

ALL KINDS OF HEATING FURNACES.

#### JOHN MARTIN STANLEY.

PATENTEE AND SOLE LICENSOR,
SHEFFIELD.

The advantages of these Furnaces are, in the first place, they effect a saving of from 25 to 50 per cent. in fuel.

2ndly.—The use and expense of grate-bars are dispensed with, as these Furances have closed fire-places, formed in brickwork.

3rdly.—They make from 80 to 90 per cent. less ashes than open fire-grate furnaces.

4thly.—They have a purer flame, the combustion is more complete, and contains less free or unmixed air or gases.

5thly.—The workmen have much less labour in working these Furnaces.

6thly.-They heat quicker, and are more under the control of the furnacemen.

7thly.—They are not affected by the position of the wind or draughts.

8thly.—The mills and workshops are cooler and more comfortable than where the open fire-grate furnaces are used.

For Prices and other information apply to

J. M. STANLEY, 27 CHANGE ALLEY, SHEFFIELD.

#### BEARD & EVERHARD

#### REGENT'S GROVE

AND

# EYRE STREET WORKS, BIRMINGHAM.

#### MANUFACTURERS

OF

#### CHARCOAL

AND

ALL OTHER DESCRIPTIONS OF SHEET IRON.

#### ENGINEERING WORKS, POOLE, DORSET.

#### S. LEWIN'S REVISED PRICE LIST.

SUBJECT TO ALTERATION WITHOUT NOTICE

#### Portable Engines.

Pages in Catalogue, 4 and 5.

Horse Power.	Number of Cylinders.	Diameter of C		troke. Price	1
4	1	63 inche	s. 10	inches. £19	8
5	,,	71	12	,, 22	0
6	**	83 ,,	,,	,, 24	2
7	**	9 ,,	"	,, 25	8
8	,,	94 ,,	**	,, 28	9
10	,,	$10\frac{7}{8}$ ,,	14	., 32	
8	2	each 63 ,	12	,, 32	ä
10		,, 7 ,,	**	35	2
12	,,	,, 81 ,,	,,	40	ż
14	"	" 9° "	14	. 45	
16	"	,, 95 ,,	**	., 50	
18	"	,, 101 ,,	16	, 56	
20		, 102 ,			á
25	**	10	**	72	ä
30	**	1.9	**	- 05	
00	**	,, 10 ,,	,,,	11	a

#### Stationary Steam Engines, on Multitubular Boilers.

Page in Catalogue, 7.

									-
8	SINGLE	CYLIN	DER.		1	DOUBLE	CYLI	NDER.	- 100
Horse Pow	er.			Price.	Horse Pow	er.			Prim.
4			•••	£193	8	•••		•••	£308
5			•••	210	10		•••	•••	335
6	•••			232	12		•••	•••	390
7		•••	•••	248	14		•••	•••	440
8	•••	***	•••	270	16	***	• • •	•••	455
10			•••	309	18	•••	•••	•••	544
					20	•••			583
					25	•••	•••	•••	704
					30	•••	•••	• • •	\$3:

#### Steam Launch Engines.

Prices on Application.

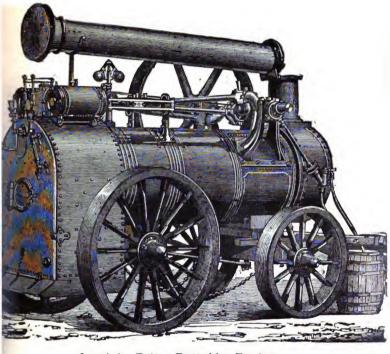
Page in Catalogue, 3.

Traction Engines.

	SINGLE	CYLIN	VDER.		DOUBLE CYLINDER.							
Horse Powe	r.			Price.	Horse Powe	r.			Prize.			
6		•••		£405	10	•••			£383			
8 *		•••		484	12				663			
10		•••		555	14	•••			769			

#### Tramway Locomotive Engines.

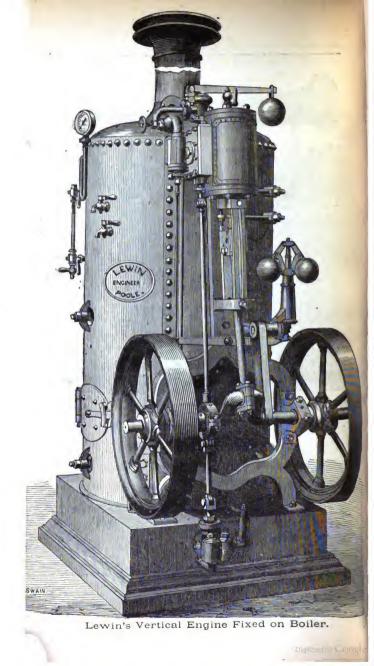
Prices and Particulars on Application.



Lewin's Prize Portable Engine.

#### Prices of these Engines are under:-

		SIR	GLE	CYLINDE	R.		1	DOUBLE CYLINDER.						
4-	Horse	Pow	er			£176	8-	Horse	Pow	er	•••			
5	19	**		***	•••	195	10	,,	99	••	•••	•••	£316	
6	>>	99	•••	•••	•••	216	12	"			***	•••	364	
7	**	79		•••		230	14	**	**	•••		•••	400	
8	99	**			•••	250	16	99	91		• • •	•••	450	
10	99	"	•••	•••	•••	290	18	29	**	•••	•••	•••	500	
							20	99	**	•••	•••		520	
							25	**	22	•••			620	
							30	2.9	"	• • •	•••	•••	775	



#### S. LEWIN'S REVISED PRICE LIST-continued.

#### Horizontal Fixed Engines.

Pages in Catalogue 8 and 9.

	CLASS I		CLASS II.						
Horse Power.	Engine only.	Engine and Cornish Boiler.	Horse Power.	Engine only.	Engine and Cornish Boiler.				
4-H.P.	£82	£165	4-H.P.	£68	£150				
6 ,,	110	220	6 ,,	80	190				
8 ,,	137	275	8 "	110	247				
10 ,,	165	330	10 ,,	130	295				
12 "	190	380	12 ,	160	350				
14 ,,	215	430	14 ,,	190	405				
16 ,,	242	484	16 ,,	210	452				
18 .,	275	550	18 ,,	220	495				
20 ,,	300	600	20 ,,	235	535				
25 ,,	360	720	25 ,,	290	630				
30 ,,	423	847	30 ,,	325	748				
35 ,,	484	968	35 "	350	800				
40 ,,	550	1100	40 ,,	390	870				

Estimates given for Larger Engines.

#### If Condensers are Fitted to the above.

Up to 10-Horse Power	£42	Up to 25 to 30-Horse Power	 £95
" 12 & 14-Horse Power	58	" 40 to 50-Horse Power	 130
16 & 20	75		

Page in Catalogue 10.

ESTIMATES GIVEN FOR CORNISH, CATER, OR OTHER BOILERS.

#### Vertical Engines.

Pages in Catalogue 11 and 12.

SE I	02	BASE	PLAT	ES.		ON	WR		r-iron ur wh		KS WI	гн
Horse Po	Price.	Horse !	Pow	er.				Price				
14		•••		•••	£82	2	1			•••	•••	£121
2	•••	•••	•••		110	:	3	•••		•••	•••	134
3	•••	•••			121		Ł		•••	•••	•••	159
4	•••	• • •			143	1	5		•••	•••	•••	184
5	•••				170	(	3	•••	•••	•••		209
6	•••		•••		192							
7			•••		220							
8					236							
9	•••	•••	•••	•••	258							
10	•••		•••	•••	275							
12	•••	•••	•••	•••	319							

#### S. LEWINS REVISED PRICE LIST-continued.

#### Thrashing Machines and Portable Engines. Pages in Catologue 13, 14, and 15.

H.P. of Engines required	SINGLE BLAST MACHI	NE	H.P. of Engines required	FINISHING MACHINE				
	£	TOTAL		£	TOTAL			
4	Engine	£313	4	Engine	£323			
5	Engine	£345	5	Engine				
6	Engine	£377	6	Engine 242 4'6" Small size 145	£387			
7	Engine	£393	7	Engine	£418			
8	Engine	£425	8	Engine				
10	Engine	£469	10	Engine	£495			

Patent Thrashing Machines Combined with Straw Elevator, to deliver at any angle.

Prices on Application.

#### Horse-Power Thrashing Machines.

					Page	in Catalo	que, 15.					
Horse	Power.				Wi	dth of Dru	m.					Price.
2-	H.P.	•••	***	•••	•••	24 in.	•••	•••	•••	•••	***	₹50
3	**		•••		•••	30 in.	•••	•••	•••	***	•••	70
4	**		•••		•••	42 in.	•••	•••		•••	***	80
4	27	•••	•••		•••	48 in.				•••	***	87
	Each	Price	includes	Macl	nine and	Horse-G	ear mo	inted o	n 4-wh	eel Car	riage.	

These Machines can be fitted with Pulleys to be driven by Steam Power if required.

Pages in Catalague 16 to 91

#### Patent Stacker and Elevator.

		2 447	yes on c	aun vy s	e, 10 a				•	
Price Complete	•••	•••	•••	•••	•••	•••	•••	•••	•••	250
Horse-Gear extra	•••	•••	•••	•••	•••	•••	•••	•••	•••	5

#### Grinding Mills.

	Pages in C	Catalogue				
				RICE OF E	ACH MILI	
			2 ft. 8 in. Diameter.	3 ft. Diameter.	3 ft. 6 in. Diameter.	4 ft. Diameter.
If fitted with Derbyshi	ire Grey Stone		£53	£60	£72	£88
" French I	Bedstone and Gre	y Runne	58	67	82	99
" French S	Stones		64	75	88	114
If provided with Loose	Pulley				£3	10s, ex:
,, Impro	oved Crane to lift Price for Ports	the Rus	ning Stor	ne for Dres	sing £7	10s. "

#### Cement Mills.

Prices and Particulars on Application.

#### Mortar Mills.

Page in Catalogue, 29.

5	ft.	pan	•••	•••		•••		•••			•••	•••	£90
6	,,	,,	•••	***	•••	•••	•••	•••	•••	•••	•••	•••	100
8	**	99		•••	•••		***	***	***	•••	***	***	120
				•••		•••	•••	•••	•••	•••		•••	140
9	,,	39		•••	•••	•••	•••	•••	•••		•••	•••	160

#### Stuff Runners. Clay and Rough

Prices on Application. Page in Catalogue, 28,

#### Pipe, Brick, and Tile Machines. Patent Pages in Catalogue, 26 and 27.

Large Size Small Size	 •••			•••		•••	•••	•••	•••	£175
Small Size	 •••	•••	•••	•••	***	•••	•••	***	•••	135

#### Draining Pipe. and Tile Machine.

Page in Catalogue, 28.

Price with One Die £50.

Prices for Brick Machinery on Application. Page in Catalogue, 30.

#### Self-Acting Saw Bench.

Page in Catalogue, 24,

Size of Table, 7ft, long, by 3 ft, 3 in., 48 in. Saw	•••	•••	•••		£75	08.
Movable Carriage, 20 ft. of Rails for same	•••	•••	•••	***	25	08.
Boring Table, fitted with Rising Apparatus	***	•••		•••	3	08.
Spindle bored up, and fitted with Set of Bits and A	Augers	•••	•••	•••	1	10s.

#### Saw Bench.

Page in Catalogue, 25.

Table 4 ft. by 2ft., with 24 in. saw	•••	•••	•••	£18	08.
" 5 ft. by 2½ ft. " 30 in. "	•••	•••	•••	30	08.
Boring Table, fitted with Rising Apparatus, extra	•••	• • •	•••	2	15s.
Spindle bored up and fitted with Set of Bits or Augers	•••	•••	•••	1	58.

Portable Steam or Hand Cranes	•••	•••		•••	)
Patent Hay and Waggon Loader		•••		•••	Prices and Particular
Patent 2 and 3 Furrow Ploughs	•••	•••	•••	•••	on Application.
stone or Ore Crushing Machine	•••	•••	•••	•••	J

ESTIMATES GIVEN FOR WINDING, PUMPING, AND OTHER GEAR.

A rise of 10 per cent. on all Goods not named in this List.

#### INTERNATIONAL EXHIBITION, 1862,

AND

PARIS EXHIBITION, 1867.





#### TWO MEDALS AT EACH





FOR

#### QUALITY OF PIG IRON,

AND

EXCELLENCE OF WORKMANSHIP

MACHINERY.

# LILLESHALL COMPANY,

COAL AND IRON MASTERS' ENGINEERS, ETC.

SHIFNAL, SHROPSHIRE.

#### MANUFACTURERS

OF ALL DESCRIPTIONS OF

MILL, FORGE AND MINING MACHINERY,

AND

STEAM HAMMERS.

# ISAAC JENKS AND SONS,

# MINERVA & BEAVER IRON, STEEL, & SPRING WORKS,

# WOLVERHAMPTON.

MANUFACTURERS OF CAST, SPRING, BLISTER, AND OTHER STEEL, RAILWAY SPRINGS, MERCHANT BARS AND SHEETS, WIRE RODS, ETC., ETC.

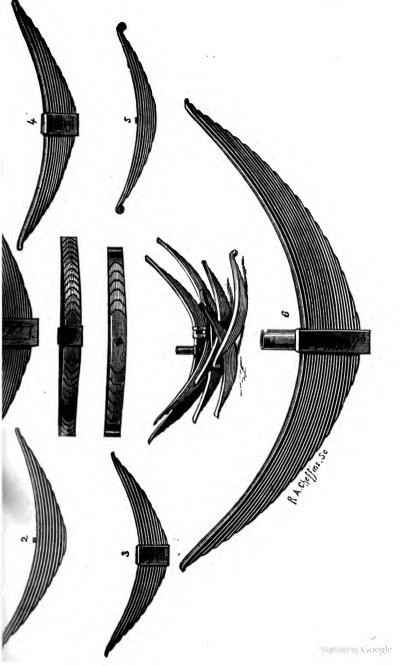
# TAPER BRAKE LEVER BARS A SPECIALITY.

BRAND OF STEEL, 'JENKS.' BRAND OF IRON, 'BEAVER.'









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FOR INDIA



REGISTERED TRADE MARKS.









SAXON.

#### DESCRIPTION OF MANUFACTURED IRON OF BEST QUALITIES.

Flat Bars from 3 to 12 inches wide.

Round ditto, from to 8 inches diameter. Square ditto, from to 5 inches.

Half-round, Feather and Square Edge, to 6 inches wide.

Beveled, Octagon, Hexagon, Oval, Moulding, and every other description of Fancy Iron.

Best, Best Best, and Treble Best Rivet Iron, Plating Bars, &c.

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Sheets-Single, Double, and Lattin.

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Tee, Equal, and Unequal Sided, and Double Tee.

Sash Bars and Trough Iron of various sections.

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Rivets for Shipbuilding and best Boiler Work.

Best Yorkshire Iron supplied of the various brands.

Hot and Cold Blast Melting and Forge Pig Iron.

Rolls turned for irregular sizes of Iron according to agreement.

All information as to Prices &c. can be obtained at

#### 3 BILLITER SQUARE, LONDON, OR AT DUDLEY.

#### HADFIELD'S STEEL FOUNDRY COMPANY,

'HECLA' FOUNDRY,

NEWHALL ROAD, ATTERCLIFEE,

#### SHEFFIELD.

**MANUFACTURERS** 

OF

EVERY DESCRIPTION

OF

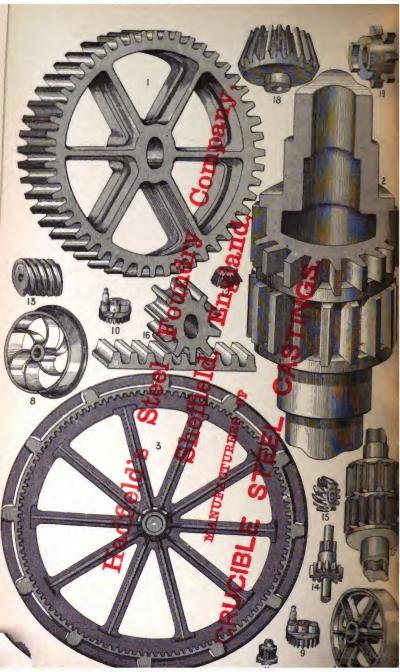
# CRUCIBLE CAST STEEL CASTINGS,

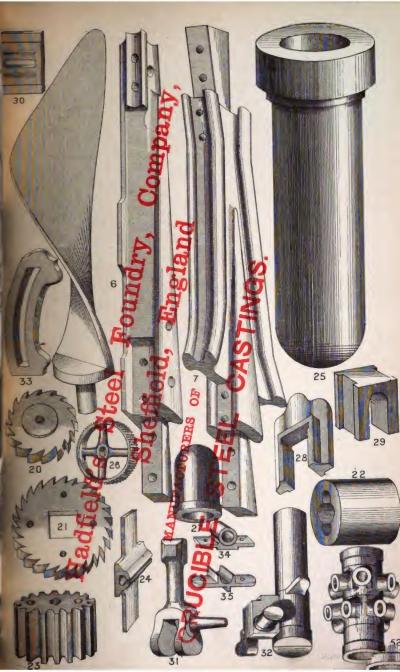
COMPRISING

HYDRAULIC CYLINDERS, SHIP PROPELLERS, PINIONS; RAILWAY, TOOTH, TRAM, and CORVE WHEELS; CROSSINGS, HORN BLOCKS, AXLE BOXES, CROSSHEADS, SKIFES for STEAM PLOUGHS, PLOUGHSHARES, CULTIVATORS, FINGERS for REAPING MACHINES, &c. &c.

THE NEW YORK, PUBLIC TIBRARY

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Death rolling with

#### THE HADFIELD STEEL FOUNDRY COMPANY'S

#### SHEET OF DESCRIPTIVE DRAWINGS.

#### ENTERED AT STATIONERS' HALL.-COPYRIGHT.

- 1. Spur Wheel
- 2. Double Pinion
- 3. Wheel Coal Cutting Machine
- 4. Bogie Wheel
- 5. Ship Propeller
- 6. Railway Crossing Point 7. Railway Crossing 8. Corve Wheel

- 9. Pinion
- 10. Pinion
- 11. Pinion and Clutch
- 12. Bevil Wheel
- 13. Worm Wheel
- 14. Pinion
- 15. Worm Pinion
- 16. Pinion and Rack
- 17. Double Pinion
- 18. Bevil Wheel 19. Chain Pinion and Clutch
- 20. Ratchet Wheel 21. Bone Cutter
- 22. Coupling Box Pumps
- 23. Centrifugal Piston, for Winders'
- 24. Colliery Cage Guide 25. Hydraulic Cylinder
- 26. Change Wheel 27. Small Hydraulic Cylinder
- 28. Horn Block 29. Axle Box
- 30. Valve Face
- 31. Connecting Rod
- 32. Hydraulic Pump 33. Quadrant Link
- 34. Colliery Tub Pedestal 35. Ditto ditto

- 36. Housing Screw Box
- 37. Smiths' Anvil 38. Punching Head
- 39. Double Crank
- 40. Clutch Box
- 41. Steam Hammer Anvil
- 42. Steam Hammer Tup
- 43. Shear Slide Block
- 44. Ditto
- 45. Engine Crank
- 46. Clamp
- 47. Wood Cutter
- 48. Link for Endless Chain
- 49. Barrow Wheel
- 50. Disc Wheel
- 51. Wheel and Pinion 52. Gun Carriage Wheel Nave
- 53. Crosshead
- 54. Charging Barrow Wheel
- 55. Tram Wheel 56. Chock
- 57. Skife for Steam Plough
- 58. Cultivator 59. Ditto
- 60. Ditto

- 61. Ditto
  62. Ploughshare
  63. Finger, for Reaping Machine
  64. Lever
  65. Boiler Bear

- 66. Spanner 67. Ditto 68. Ditto
- 69. Cart Bush

N.B.-Crucible Steel Castings possess four times the strength of Castings made from the Best Cold Blast Iron; and where great strength. lightness, and durability are essential, are highly advantageous and economical.



THE above Engraving represents Mr. R. HADFIELD'S PATENT IMPROVED DOUBLE-DISC RAILWAY WHEEL, the Tyre of which is Steel or Iron, with a Metal Centre welded thereto. These Wheels have created considerable attention during the last nine months among Railway Engineers and others.



#### EDWARD DAVIES,

'CROWN'

#### GALVANIZED IRON WORKS,

WOLVERHAMPTON.



ESTABLISHED 1838.



#### EDWARD DAVIES—Continued.

#### MANUFACTURER

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#### GALVANIZED CORRUGATED SHEETS

FOR ROOFING PURPOSES.

IN ALL SIZES OF CORRUGATION.



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PLAIN FLAT SHEETS, MADE EXPRESSLY FOR WORKING UP

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IMPROVED

GALVANIZED ROOFING TILES,

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# TINNED SHEET IRON, GALVANIZED IRON RIDGING, GALVANIZED HOOPS.

Manufacturer of all Descriptions of Galvanized Iron Goods.

#### GALVANIZED FITTINGS

FOR

SHEETS, TILES, &c.

#### GALVANIZED TINNED MACHINE-MADE GUTTERS,

RAIN-WATER PIPES, &c.

GALVANIZED IRON ROOFS,

AND

#### BUILDINGS FOR HOME & EXPORT

Fixed complete, or fitted for Erection.

#### WOLVERHAMPTON-CROWN WORKS.

LIVERPOOL- 17 SWEETING STREET.

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#### PARTICULARS & SIZES OF IRON

MANUFACTURED BY

#### ROBERT HEATH & SON.

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NORTON AND RAVENSDALE

IRON WORKS,

NORTH STAFFORDSHIRE.

#### BRANDS.

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#### PLATES.

All qualities not thinner than \frac{1}{8} of an inch, or thicker than \frac{1}{8} inches, or wider than 51 feet.

#### ROUNDS.

#### SQUARES.

From  $\frac{3}{16}$  of an inch to 6 inches. Sizes vary by 32 up to 11 inches.  $\frac{1}{16}$  from  $1\frac{1}{8}$  to  $2\frac{1}{2}$  ,,

From  $\frac{3}{16}$  of an inch to 6 inches. Sizes vary by  $\frac{1}{32}$  up to  $1\frac{1}{8}$  inches. 1 from 11 to 2

#### FLATS.

From 3 of an inch to 8 inches wide.

The sizes vary in width by  $\frac{1}{8}$  from  $\frac{3}{8}$  to 2 inches, thickness not under  $\frac{3}{16}$ ,, 8 thickness not under 1

#### HOOPS AND STRIPS.

From  $\frac{1}{2}$  inch to  $1\frac{1}{8}$  inches, not thinner than 23 W.G.

,, 2 20 11 ,, ,, " " 21 ,, 3 18 " " " 15

Waved 11 inches, not thinner than 18 W.G.

D 2

#### OCTAGON IRON.

 $\frac{15}{32}$  to  $\frac{5}{8}$  inches. The sizes vary by 1/32.

#### CAN TOP.

1, 5 and 3 inch.

#### HALF-ROUNDS & CONVEX.

#### FEATHER EDGE.

Width.		Thickness.	Width.		Thickness.	Width.		Thickness.
3	×	11 1	15	×	1 1	11	×	1
3	×	1	11	×	5 R	1 i	×	3 8
3	×	3	11	X	1/2	11	×	18
21	×	1	$1\frac{1}{2}$	×	178	1	×	1/2
21	×	3 8	11/2	×	3 8	1	×	3 8
21	×	5	$1\frac{1}{2}$	×	16	1	×	18
21	×	1	$1\frac{1}{2}$	×	1	1	×	1
21	×	38	13	×	5 8	1	×	16
21	×	1	$1\frac{3}{8}$	×	1/2	7 8	×	3
2	×	1	13	×	7 7 8	7 8	×	15
13	×	5 8	11	×	1/2	3	×	3
13	×	1/2	11	×	7 16	3	×	16
$1\frac{3}{4}$	×	3 8	11	X	3			

#### SQUARE EDGE (1 inch).

Width.		Thickness.	Width.		Thickness.	Width.		Thickness
3	×	13	21	×	3	13	×	5
3	×	11	21	×	5 8	$1\frac{3}{4}$	×	1 9
3	×	1	21	×	1	14	×	3
21	×	8	21	×	3 8	11	×	5
$2\frac{1}{2}$	×	1 2	$1\frac{3}{4}$	X	ă 4	13	×	5 8

#### BEVELLED TYRE.

	Size.	Thick			
13	×	11	×	8	
11	×	1,1	×	8	

#### SPOKE IRON.

Width. Thickness.  $3\frac{1}{8} \times \frac{1}{9}$  on each side 1 inch in the middle.  $3\frac{1}{9} \times \frac{3}{9}$  at each end, 1 in. in the mid.

#### TEE IRON.

	Size.		Thickness.		Size.		Thickness.
0		4.5		1 .	Olze.		I mickness.
8	×	45	$\frac{5}{8}$ to $\frac{3}{4}$	4		21	H 22 T
6	×	4	TE " 3	4	× 2	2 .	$\frac{3}{8}$ ,, $\frac{1}{2}$ , $\frac{5}{16}$ ,, $\frac{7}{16}$
6	×	35	1 " 5	31	× 8	31	5 , 2
6	×	$\frac{3\frac{5}{8}}{3\frac{1}{2}}$	7 5	$ \begin{array}{c c} 3\frac{1}{2} \\ 3\frac{1}{2} \\ 3 \\ 3 \\ 3 \end{array} $	× 8	$\frac{3\frac{1}{2}}{3}$	$     \begin{bmatrix}       5 \\       \hline       6 \\       \hline       8 \\       \hline       3     \end{bmatrix}   $ $     \begin{bmatrix}       1 \\       \hline       2 \\       \hline       3 \\       \hline       3 \\       \end{bmatrix}   $ $     \begin{bmatrix}       1 \\       \hline       2 \\       \hline       3 \\       \end{bmatrix}   $
6	×	3	Te " 8	32	×	1 3 <u>1</u> 3	3 7 1
c		91	ਸ਼ੇ ਮ ਲੇ	0	^ 3		8 " 2
0	X	$\frac{2\frac{1}{2}}{5}$	ਭ ਮਾਂ ਬ	0	×	2	ਰੇ " ਹੈ
5	×××	5	$\frac{1}{2}$ and $\frac{5}{8}$	3	× {	3 .	ਿੱਚ " ਤੋਂ
5		$4\frac{1}{2}$	$\frac{1}{2}$ ,, $\frac{5}{8}$	23	× 2	23	A 12 9
5	×	4	$\frac{1}{2}$ , $\frac{5}{8}$	23	× 2	23 21 21	3 . 5
5	×	31	1 2 2 5 N	21	× 5	21	1 " 1
6 6 6 6 5 5 5 5 5 5 5 4 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1		$\frac{3\frac{1}{2}}{3}$	7 to 4	$ \begin{array}{c} 2\frac{3}{4} \\ 2\frac{3}{4} \\ 2\frac{1}{2} \\ 2\frac{1}{4} \end{array} $	× 2	21 .	3 7 1
5	× ×	91	5 1	24	0 6	Ŧ.	Tg >> 2
41	<u>.</u>	$2\frac{1}{2}$ $4\frac{1}{2}$	Te " 2	12			E " H
42	×	49	र्षेष्ठ भ है	14	×	4	ie " 8
4 1/2	×	4 ° 5	7 16 " N	11/2	× :	11.	18 22 8
4	×	5	$\frac{1}{2}$ and $\frac{5}{8}$	11	× :	11 .	3 1
4	×	$4\frac{1}{2}$	$\frac{1}{2}$ ,, $\frac{5}{8}$	11	× :	3	and 3
4 4 4	X	4	3 to 5	$\begin{array}{c} 2 \\ 1\frac{3}{4} \\ 1\frac{1}{2} \\ 1\frac{1}{4} \\ 1\frac{1}{8} \\ 1\frac{1}{8} \end{array}$	×	ı°	1 3
4 4	×	$\frac{3\frac{3}{4}}{3\frac{1}{2}}$	1 to 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1	1 1	×	1	1976-1919-1919-1919-1919-1919-1919-1919-
4	×	31	3 " 8	l ī	×	7	8 " 16
4	×	3	8 22 8	_		7 7 7 8 3	ह " इड
4			8 " 8	7 7 7	×	8	है " दि
4	×	23	8 , 1	7	×	2	H 22 1 H

#### GRATE BARS.

Width.		Thickness.		Width.			Thickness,		
4	×	$\frac{7}{8}$	×	38	3	×	1	×	1
$3\frac{5}{8}$	×	$1\frac{3}{8}$	×	76	3	×	1	×	1
35	×	$1\frac{1}{8}$	×	1/2	3	×	3	×	3
31	×	$1\frac{1}{2}$	×	1 2	$2\frac{1}{2}$	×	1	×	1
$3\frac{1}{2}$	×	1	×	1	_				-

#### RAILS.

Bridge	12 to	16 lbs.	per yard
",	22 ,,	24 ,,	"
T		18 ,,	"
"	24 "		"
Train	22 ,,		,,
Street	36 ,,	38	**

#### SASH IRON.

Wide.	Thi	ck.	Circle.				
2	×	3	11	×	78		
13	×	3	11	×	7 6		

#### GLUT IRON.

31	×	13
12	×	$\frac{1\frac{3}{4}}{1\frac{1}{6}}$

#### CHANNEL IRON.

 $4 \times 2 \times \frac{5}{16}$ 

#### ANGLES.

		Size.		Thickness.	Size.		Thickness.	
	6	×	6	$\frac{1}{9}$ to 1 in.	Bulb 31/2	×	$2\frac{1}{2}$ $\frac{5}{16}$ to $\frac{7}{16}$ in.	
	6	×	5	$\frac{1}{2}$ ,, $\frac{1}{7}$ ,, $\frac{7}{8}$ ,, $\frac{7}{16}$ ,, $\frac{8}{8}$ ,, $\frac{7}{16}$ ,, $\frac{1}{8}$ ,,	Round back 33	×	$3\frac{3}{8}$ $\frac{3}{8}$ $\frac{5}{8}$ $\frac{5}{8}$ $\frac{5}{8}$	
	6	×	4	7 16 17 7 17	31	×	31 5, 5,	
	6	×	$3\frac{1}{2}$	16 " 1 "	31	×	3 5 8 7	
	6	×	3	$\frac{3}{8}$ , $\frac{7}{8}$ ,	Boiler 1 31	×	23 5, 5, 5,	
	$5\frac{1}{2}$	×	41	16 " 7 "	Boller 3	×	3 16, 3,	
	51	X	$\frac{4\frac{1}{2}}{3\frac{1}{2}}$	7 16 " 7 " 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0	×	$3 \frac{1}{4} \cdot \frac{3}{4} \cdot $	
	5½ 5½ 5 5	×	5	$\frac{1}{2}$ ,, 1 ,,	3 3 3	×	$2\frac{3}{4}$ $\frac{1}{4}$ , $\frac{5}{8}$ ,	
	5	×	11	16 " 7 "	3	×	21 1 . 5 .	
	5	×	4	76 11 7 11		×	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	
	5	×	31	3	23	×	23 1 1	
	5	×	3	16 " 7 "	23	×	21 1, 1, 1	
	$4\frac{1}{2}$	×	$4\frac{1}{2}$	16 " 7 "	$2\frac{1}{2}$	×	$2\frac{1}{2}$ $\frac{3}{16}$ , $\frac{1}{3}$ ,	
Round back	41	×	45	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	234 24 2 2 2 1 2 2 1 4 2 2 1 4 2 2 2 1 4 2 2 2 1 4 2 2 2 1 4 2 2 2 2	×	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	
	$4\frac{1}{2}$ $4\frac{1}{2}$	×	4	$\frac{3}{8}$ " $\frac{7}{8}$ "	$2\frac{1}{2}$	×	12 16 7 16 7	
Obtuse	41	×	4	$\frac{3}{8}$ , $\frac{5}{8}$ ,	21	×	$2\frac{1}{4}$ $\frac{3}{16}$ , $\frac{1}{2}$ ,	
	$4\frac{1}{2}$ $4\frac{1}{2}$	×	$3\frac{1}{2}$	16 " 5 "	2	×	$2 \frac{1}{8}, \frac{1}{2},$	
	$4\frac{1}{2}$	×	3	$\frac{3}{8}$ , $\frac{7}{8}$ , $\frac{3}{8}$ , $\frac{7}{16}$ , $\frac{3}{4}$ , $\frac{7}{1}$ , $\frac{1}{4}$ , $\frac{1}{1}$ ,	2	×	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	
Bulb	41	×	$2\frac{1}{2}$	3 n Ten	Square edge $1\frac{3}{4}$	×	$1\frac{3}{4}$ $1\frac{3}{6}$ , $\frac{1}{2}$ ,	
	4	×	4		Square edge 15	×	$1\frac{5}{8}$ $\frac{1}{4}$ ,, $\frac{3}{8}$ ,	
	4	×	$3\frac{1}{2}$	5 7 8 11 1 1 3 4 11 1 1 5 11 1 1 7 8 11	11/2	×	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	
	4	×	3	4 " 4 "	14	×	11 1 , 5,	
	4	×	$2\frac{1}{2}$	1 1 8 11	11/8	×	$1\frac{1}{8}$ $\frac{1}{8}$ ,, $\frac{5}{16}$ ,	
	$\frac{3\frac{1}{2}}{5\frac{1}{2}}$	×	$3\frac{1}{2}$	1 " 3 "	1	×	$1  \frac{1}{8} \; , \; \frac{1}{4} \; ,$	
	$5\frac{1}{2}$	×	$5\frac{1}{2}$	1 ,, 1 ,,	1	×	5 16	
Round back		×	5	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1	×	1	
	31/3 1/3 1/3 1/3 1/3 1/3 1/3 1/3 1/3 1/3	×	$3\frac{1}{2}$	3 " 5 " 1 " 1 " 1 " 1 " 1 " 1 " 1 " 1 " 1	7 8 3 4 3 4	×	$\frac{7}{8}$ $\frac{1}{8}$	
	31	×	3	$\frac{1}{4}$ ,, $\frac{3}{4}$ ,,	3	×	3 1 8	
	31	×	$\frac{2\frac{3}{4}}{2\frac{1}{3}}$	16 " 5 " 16 " 5 "	3	×	3 1	
	31	X	21	5 , 5 ,,				

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										2-0	B CVI.
Flat.	round, o	r square, t	0 34 (	Cwt.	•••	•••	•••		***		24
		3 t			•••		•••		***		25/
**	•	5 an	d upw	ramle	•••					•••	27/
***	:	, , , ,	" ap		•••	•••	•••	•••	•••	•••	
Flats,	14 by 4	and upw	ards	***		•••		***	•••	•••	24
**	under	thick to	1	•••	•••	•••	•••		•••	•••	25
"	. 1	,,	Ī			•••	•••	•••	•••	•••	26/
	"										29
_ "	19	"			***	•••	•••	•••	•••	***	201
For es	ch d in.	less than	11 w	ide, ext	ra 10/-	per To	n.				
Sanan	og fin	and upwa	rda								24
~quas.				•••	•••	•••	•••	•••	•••	•••	-
,,,	7/16			•••		•••			•••	•••	26
**	a and	d 5/16 in.								•••	28
**	8	4 0/10 120	***	•••	•••	•••	•••	***	•••	•••	

### PRESENT PRICES-continued.

Rounds, # in	and unwa	rde								PER CWT.
			•••	•••	•••	•••	•••	•••	•••	24/
,, 7/16	and in.	•••	•••		•••	•••	•••	•••	•••	26/
,, 5/16	in g in.	•••	•••	•••	•••	•••	•••	•••	•••	28/
				•••	•••	•••	•••	•••	•••	30/
RIVET IRC	N same n	ricos a	e shor	•••	•••	•••	•••	•••	•••	32/
CHAIN IRO	N. £2 per	Ton e	xtra.							
(B) Best E	ARS and	RO	DS. e	xtra ne	r Cwt	3/				
.,			, ·	-tru pe	,	01.				
	'BOW	/I IN	101	PO		D D				
	BUV	LII	1G	ВО	ILE	R F	LAT	E5.		
Plates under			•••							29/
	and under	3 Cwt		•••		• • • •	•••	•••	•••	30/
3 ,,	**	31 ,,		•••	•••	•••	•••	•••	•••	32/
3½ "	,,	4 ,,		•••	•••		•••		•••	34/
4 "	,,	5 ,,			•••	•••		•••	•••	37/
5 "	**			•••	•••	•••	•••		•••	40/
6 ,,	**	7 ,,		•••	•••	•••	•••		***	43/
7 "	and upv	vards		•••	• • •		•••	•••	•••	46/
Hammered :	and Chequ	ered I	Plates;	and a	ll Plat	es diffe	ering fr	om a so	uare	
form or	regular tap	per, ex	tra per	Cwt.,	3/.					
Plates exceed	ling 6 ft. 0	in. wi	de, 2/	per Cw	t. extra	١.				
SHEETS, 11	to 17, W.	G.			•••					31/
STRIPS for	Welded Tu	ibes, 1	to 10,	W.G.	•••		•••			31/
Ditto	ditte	0 11	to 14,	do.	•••	•••	•••	•••	•••	32/
			_			_			•••	
	'BO	1///	INC	' A	NG	E	IRO	NI		
	50	, , , , <u>, , , , , , , , , , , , , , , </u>								
L&T Iron	not exceed	ding 10	unite	l inches	3			•••		
		ding 10	unite	l inches	3				•••	
	not exceed additiona	ding 10 d inch,	unite extra	l inches	t., 1/.			•••	•••	
	not exceed additiona	ding 10 d inch,	unite extra	l inches	t., 1/.			•••		
	not exceed additiona	ding 10 linch,	united extra	l inches per Cw and up	t., 1/.	 Thin		•••	•••	
	not exceed additiona	ding 10 linch,	united extra	l inches per Cw and up	t., 1/.	 Thin	 Edge	" В*О,		
For each	not exceed additiona BOW	ding 10 d inch,	united extra NG,'	and up	t., 1/.	 Thin		" В*О,		05/0
For each	not exceed additional BOW	ding 10 l inch,  VLIN  AIL	unite extra NG,' WA'	and up	t., 1/.	 Thin	 Edge	в <b>*</b> О,	•••	25/6
For each	BOW R. Wt	ding 10 1 inch, VLIN AIL' 	Vanite extra	and up	t., 1/.	Thin	Edge ARS	B*O,		27/
For each Under 3½ Cv 3½ Cwt. and 4 ,,	BOW R vt under 4 Cv  , 5½	ding 10 1 inch, VLIN AIL'  wt.	NG,'	and up	YRE	 Thin	Edge ARS	B*O,		27/ 29/
For each  Under 3½ Cv 3½ Cwt. and  4 ", and	HOW R. W under 4 Cv under 4 Cv upwards	ding 10 l inch, VLIN AIL' wt.	vunite extra NG,' WA'	and up	t., 1/.	Thin B	Edge ARS	B*O,		27/ 29/ 33/
For each Under 3½ Cv 3½ Cwt. and 4 ,,	HOW R. W under 4 Cv under 4 Cv upwards	ding 10 l inch, VLIN AIL' wt.	vunite extra NG,' WA'	and up	YRE	Thin	Edge ARS	B*O,		27/ 29/
For each  Under 3½ Cv 3½ Cwt. and  4 ", and	not exceed additional	ding 10 l inch,  /LIN  AIL'  wt.   per Ton	NG,'	and up	YRE	Thin B.	Edge ARS	B*O,		27/ 29/ 33/
For each  Under 3½ Cv 3½ Cwt. and  4 ", and	not exceed additional	ding 10 l inch,  /LIN  AIL'  wt.   per Ton	NG,'	and up	YRE	Thin B.	Edge ARS	B*O,		27/ 29/ 33/
For each Under 3½ Cv 3½ Cwt. and 4 ", and Tyre Bars be	r not exceed additional additiona	ding 10 I inch,  VLIN  AIL'  wt.  "  Per Ton  (RES,	wE	and up	YRE	Thin BLO	Edge ARS	B*O,		27/ 29/ 33/
For each Under 3½ Cv 3½ Cwt. and 4 ", and Tyre Bars be	not exceed additional	ding 10 I inch,  VLIN  AIL'  wt.  "  Per Ton  (RES,	wE	and up	YRE	Thin BLO	Edge ARS	B*O,		27/ 29/ 33/
For each Under 3½ Cwt. and 3½ Cwt. and 4 '' 5½ '', and Tyre Bars be	HOW R. W under 4 Cv 15½ upwards ent, extra p	ding 10 I inch,  VLIN  AIL'  wt.  "  Per Ton  (RES,	wE	and up	YRE	Thin BLO	Edge ARS CKED	B*O,		27  29  33  7 6
For each Under 3½ Cv 3½ Cwt. and 4 ,, and Tyre Bars be Under 3½ Cv	not exceed additional BOW R. R. Wt under 4 Cv 4 Cv 4 Cv 4 TY	VLINALL' wt. "CRES,	wE	and up	YRE	Thin BLO	Edge ARS CKED	B*O,	::: ::: ::: S.	27/ 29/ 33/ 7/6
For each Under 3½ Cv 3½ Cwt. and 4 ,, and 5½ ,, and Tyre Bars be Under 3½ Cv 3½ Cwt. and	not exceed additional BOW R. R under 4 Cv TY  BOWL rt under 4 Cv extra p. TY	VLINALL' wt. "CRES,	wE	and up  Y T   LDED  O  WEL	YRE and and	Thin BLO ESS	Edge ARS CKED	B*O,	   S.	27/ 29/ 33/ 7/6
For each  Under 3½ Cwt. and  4  "5½", and Tyre Bars be  Under 3½ Cwt.  under 3½ Cwt.  under 3½ Cwt.	not exceed additional BOW R. R Cunder 4 Cu., 5½ upwards ent, extra p. TY. BOWL rt under 4 Cu., 5½ upwards	VLINALL' wt. "CRES,	wE	and up Y T LDED	YRE and oR DLI	Thin BLO	Edge ARS	B*O,	  	27/ 29/ 33/ 7/6 26/ <b>6</b> 28/ 31/
For each  Under 3½ Cwt. and  4  "5½", and Tyre Bars be  Under 3½ Cwt.  under 3½ Cwt.  under 3½ Cwt.	not exceed additional BOW R. R under 4 Cv TY  BOWL rt under 4 Cv extra p. TY	VLINALL' wt. "CRES,	wE	and up  Y T   LDED  O  WEL	YRE and and	Thin BLO ESS	Edge ARS CKED	B*O,	   S.	27/ 29/ 33/ 7/6
For each  Under 3½ Cwt. and  4  "5½", and Tyre Bars be  Under 3½ Cwt.  under 3½ Cwt.  under 3½ Cwt.	not exceed additional BOW R  vt under 4 Cv., 5½ upwards ent, extra p  TY  BOWL  rt Ty  under 4 Cv., 5½ upwards ent, extra p  under 4 Cv., 5½ upwards	VLINALL' wt. " rer Ton res, LINC wt. "	WE	and up Y T LDED	yRE and or DLI	BLO	Edge ARS CKED TY	B*O,	  	27/ 29/ 33/ 7/6 26/ <b>6</b> 28/ 31/
For each  Under 3½ Cwt. and  4  "5½", and Tyre Bars be  Under 3½ Cwt.  under 3½ Cwt.  under 3½ Cwt.	not exceed additional BOW R. R Cunder 4 Cu., 5½ upwards ent, extra p. TY. BOWL rt under 4 Cu., 5½ upwards	VLINALL' wt. " rer Ton res, LINC wt. "	WE	and up Y T LDED	yRE and or DLI	BLO	Edge ARS CKED TY	B*O,	  	27/ 29/ 33/ 7/6 26/ <b>6</b> 28/ 31/
For each  Under 3½ Cv 3½ Cwt. and 4 '', 5½ '', and Tyre Bars be  Under 3½ Cv 3½ Cwt. and 4 '', and 5½ '', and	not exceed additional BOW R. R. W Sold upwards ent, extra p. TY BOWL rt under 4 Cr under 4 Cr under 4 Cr under 4 Cr under 5 Cr under 5 Cr Sold upwards 'BOWL Pt 'BO	VLIN	wE	A dinchee per Cwr and up Y T LDED	YRE and DLI	BLO	Edge ARS CKED TY	B*O,	  	27/ 29/ 33/ 7/6 26/6 28/ 31/ 35/
For each  Under 3½ Cv 3½ Cwt. and  4 ", and  Tyre Bars be  Under 3½ Cv 3½ Cwt. and  4 ", and  Swaged with	not exceed additional BOW R  vt Under 4 Ct 5½ upwards ent, extra p  TY  BOWL  rt under 4 Ct 5½  upwards ent, extra p  TY  Collars, other and the collars, other services and the collars, other and the collar	VLIN  (RES, LINC  Wt.  """  """  """  ""  ""  ""  ""  ""  "	wE	A dinchee per Cwr and up Y T LDED	YRE and DLI	BLO	Edge ARS CKED TY	B*O,	  	27/ 29/ 33/ 7/6 26/6 28/ 31/ 35/
For each  Under 3½ Cwt. and  4 " 5½ ", and Tyre Bars be  Under 3½ Cwt. and  4 " 5½ ", and  Swaged with 4 Cwt. and u	not exceed additional BOW R  vt Country Sold Sold Sold Sold Sold Sold Sold Sold	VLING TRES, LING WH.  """  """  """  """  """  """  """	water with the second of the s	and up Y T LDED WEL RAI	t., 1/.  YRE   and  R  DLI   ILW  Cwt	Thin BLO ESS	Edge ARS CKED TY AXL	B*O,,,	S	27/ 29/ 33/ 7/6 26/6 28/ 31/ 35/
For each  Under 3½ Cv 3½ Cwt. and  4 ", and  Tyre Bars be  Under 3½ Cv 3½ Cwt. and  4 ", and  Swaged with	not exceed additional BOW R. R. W Sold upwards ent, extra p. TY BOWL rt under 4 Co Sold upwards for BOW Collars, ou under 5 Cw. 6 c	VLIN  (RES, LINC  Wt.  """  """  """  ""  ""  ""  ""  ""  "	wEG'	A dinchee per Cwr and up Y T LDED	YRE and DLI	BLO ESS	Edge ARS CKED TY AXL	B*O,	  	27/ 29/ 33/ 7/6 26/6 28/ 31/ 35/

### PRESENT PRICES-continued.

'BO\	<b>VLIN</b>	IG'		UBL B Loco			NK	AX	LES	<b>5.</b>
From the For	ge	•••								55/
Rough Turned			•••	•••	•••		•••	•••	•••	65
Webs cut out			•••	•••			• • •	•••	•••	80/
Finished	•••	•••	•••	•••	•••	•••	•••	•••	•••	$110'_i$
		aged to	any d	' P	ns acco	rding t				
•	Of all de	scription	ons, acc		to weig			anship		
		'BO	WL	ING	' R	VE	TS.			
1, 3, 11/16th i	n. diame	ter							***	PER CHT. 29/
1, 1, 11, 10111			•••				•••		•••	31/
9/16ths	,,		•••		•••	•••	•••	•••	•••	34
<b>†</b>	21		•••	•••	•••	•••	***	•••	•••	36/
7/16ths	21		•••	•••	•••	•••	•••	•••	•••	40,
	•	вον	NLI	NG '	НС	OP	NG.			
13 in. broad a	nd upwa		er this	size sa	me as s	mall ro	ds.	•••	•••	29/
SASH IR	ON									-27
Slipers and So	ck Bars	•••	•••	•••	•••	•••	•••	•••	•••	28
	"	ВО	WLI	NG'	M	OUL	DS.			
Share, Hamme	r, and A	rm	•••	•••		•••		•••	•••	31,
Triangular		•••	•••	•••	•••	***	•••	•••	•••	28
Round and Sk	ef Plates	• • • •	•••	•••	•••	•••	•••	•••	•••	31/
'B	OWI	INC	3, V	WEL	DLI	ESS	Н	ООР	S,	
For strengther	ing Boil	er Flu	es			•••		•••	•••	45
			LON	DON	OFFIC	E	=			
114 CAN	NON	STI	REE	Т, Е	.C.—	н. Е	DR	ESS:	ER,	Agent.
J. S. KEN	INET			STAT				. Ne	w T	Zork.
				IADA .			1	, 100		. 014

S. WADDELL & CO., 27 St. John Street, Montreal.

# THE DARLASTON STEEL & IRON COMPANY,

LIMITED,

### WEDNESBURY.

10th JULY, 1873.

MANAGING DIRECTOR-WILSON LLOYD, ESQ.

## PRICE LIST of BAR IRON, HOOP IRON, SHEET IRON, AND STEEL,

Manufactured at the Darlaston Green Iron Works, and King's Hill Iron Works, Wednesbury, South Staffordshire, England.

This Price List is subject to alteration at any time without Notice.

Iron in bundles, namely—Sheets, Hoops, small Rounds and Squares, and Scrolls, will be delivered free alongside ship.—In London at 17/6 per ton extra; in Hull at 16/ per ton extra; in Liverpool at 12/6 per ton extra, in parcels of not less than 10 tons.

Iron not bundled, namely—Plates and Bars, will be delivered free alongside ship. In London at 15/ per ton extra; in Hull at 14/ per ton extra; in Liverpool at 10/ per ton extra, in parcels of not less than 10 tons.

# TRADE MARK.

### BAR IRON.

Per Ton at Works.

Flat, from 1 in. up to 6 in. wide by 4 in. and upwards

"wider than 6 in., same as plates.

"thinner than ½ in., same as hoops.

Round or Square—						
from in, to 3 in,				• •	13 10	0
over 3 in. to 31 in					13 10	0
over 31 in. to 4 in					14 0	0
over 4 in, to 41 in					15 0	0
over 41 in. to 5 in					15 10	0
Rounds only over 5 in. to 51 in.					16 10	0
Boiler Rivet Iron					14 10	0
7/16 in., round or square					13 5	0
3 in dieto					13 15	0
5/16 and No. 1 and 2 W.G., ditto					14 5	0
and No. 3 ditto					14 15	0
No. 4 ditto					15 0	0
No. 5 ditto	::				15 10	0
3/16 and No. 6 ditto		• •			16 10	0
No. 7 ditto	• •	• •	••		17 10	0
5/32 and No. 8 ditto	• •	••	••		19 0	0
No. 9 ditto	• •	••	••		20 10	0
	••	••	••	••	1 0	0
Best Bars and Rods, extra	• •	••	••	••	2 0	Ö
Best Best do. do.						

### THE DARLASTON STEEL & IRON COMPANY-continued.

31 in. to 21 ,,

6 in, to 1 in. by 3/16 to No. 12



SHE	E	Г	IRC	N.		P	8.	2
						15		0
Singles, to 20 W.G.			• •					
Doubles, 21 to 21						17	0	9
Lattins, 25 to 27								0
Extra Lattins, 23								0
Do. do. 29				• •		20	10	0
	••	••				1	0	.0
Best Sheets, extra	••	••	• •	• •		9	0	0
Best Best Sheets, extra	a · ·	• •	••	••	••	23	0	0
Charcoal Sheets, to 20 W.	G.			••	••	22	0	0
Bessemer Steel Sheets, to	20 W.	G.	**		• •	22	v	v

### TANK PLATES.

15 10 0

13 10 0

in, and 5/16 in, thick

#### PLATES. SHEETS AND

1 0 0 Over 24 superficial feet, extra Under 15 inches wide, extra 0 10 0

# TRADE MARK CHAMPION.

### HOOP IRON. 6 in. to 33 in. wide, not thinner than 14 W.G. ..

2	,, to	12 ,,		99		11	77	• •	• •			
13	,, to	13 ,,		99		18	99	• •	• •			
1	1 ., to	1 ,		99		19	29	• •	• •			6
- 6	inch	91		9.0		19	,,			14	0	- 1
3	**			99		20	,,		• •	15	0	9
ă	**			12		20	22	• •		16		0
î				**		18	**			19	10	(
F	or eac	h gauge	thinner	than	the	gaus	ges	stated,	to			
•		extra								0	10	-
P	or each	gauge i	thinner t	han 20	G.,	extra	to.	23 G.		1	0	0
Ĉ	ut to l	ength, e	ktra						••	0	10	(

BAND IRON.

### SCROLL IRON.

\$ by 5/6 and \$ \$ by 5/16 ,, \$ \$ \$ by 7/16 ,, \$ \$ \$ \$ \$ \$ 7/16 ,. \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	} £13 5	0	2 by 3/16 2 by 3/16 2 by 3/16 3 by 1	::	:: }	£14 5	0
# DY B/10 DY B	010 15		g by h		::}	£14 15	0



#### SLIT RODS.

Square Rods, from 000 rod gauge, and upwards Flat Rods, from 9 wire gauge, thick and upwards Best Rods, extra

### TIP IRON.

and upwards	 £14	15	0	1	5/16		£15	15	0	
11/32	 15	5	0	١	9/32 and 1	••	17	15	0	
Fitting Iron	 14	0	0	1	Swarf Iron		25	0	0	
Gas Strip Iron	 13	0	0	-	Bullet Iron		20	0	0	
Socket Iron	 13	0	0	-1	Tyre Iron	٠.	14	10	0	
Rails	 14	0	0	-1	Hammered Bars		32	0	0	

### THE DARLASTON STEEL & IRON COMPANY-continued.

TRADE MARK
6 34

AN	GL	E I	RO	N.		£	. d.
						17 1	
# by # Square root	• •	• •	• •	• •	••		0 0
by i ,,	• •	• •	• •	• •	• •	16 1	
g by g ,,	• •	• •	• •	• •	• •		0 0
* by * "	• •	• •	• •	••	••	15 1	
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1 by 1 ,,	• •	• •	• •		• •		
11 by 11 ,,		• •	• •	• •	p ***	14 1	0 0
14 by 14 21 by 21		• •	• •	• •	)		
15 by 15 2½ by 2½		• •	• •	• •	٠٠ ٢	14	5 0
2 by 2 3 by 3					ر		
1 by 1 ordinary					}	14 1	0 0
1½ by 1½			• •	• •			
14 by 14 31 by 31			••		\		
12 by 14 32 by 24							
12 by 12 34 by 3	••						
2 by 1 3 by 3 1							
2 by 12 32 by 32							
2 by 2 4 by 2					\		
21 by 21 4 by 21			••		\	14	0 0
21 by 2 by 3					/		
24 by 24 by 34							
27 by 23 4 by 4							
3 by 2 41 by 3							
3 by 21 41 by 31							
3 by 3 4 by 3					/		
41 by 41 1 5 he st	••					14 1	0 0
o by a						15	0 0
5 by 5	• •	••	••	• •		On a	
8 by 3 8 by 3½	••	• •	••	••		cati	on
8 by 4½	• •	• •	• •	• •	,		0 0
Best Angles, extra	• •	••	••	••	••		0 0
Best Best Angles	••	• •	• •	• •	• •	2	U



	BEST	ГТ	EE	IR	ON.			
1 by 1						}	6 10	0
11 by 11			• •		• •	)		
1 by 1 i	31 by 31		• •	• •	••	)		
12 by 13	3½ by 3½	• •	• •	••	••			
2 by 12	31 by 31	• •	• •	••	••			
2 by 2	34 by 3	• •	• •	••	• •			
21 by 21	3½ by 4½	• •	••	• •	• •			
24 by 2	4 by 2	• •	• •	••	• •			
21 by 21	4 by 21	••	• •	• •	••	/	15 0	0
21 by 3	4 by 21	• •	• •	••	••	/		•
23 by 31	4 by 3 4 by 31	••	• •	••	••	(		
3 by 11		••	••	••	••			
3 by 2½ 3 by 8	4 by 4	• •	• •	••	••			
3 by 8 3 by 31	41 by 2 41 by 21	••	••	• •		::		
3 by 4	5 by 21	••	••	•••	•••	:: 1		
3 by 5	5 by 3	••	••		• • • • • • • • • • • • • • • • • • • •			
3 by 51	51 by 3	••	•••			5		
3 by 6	4 by 41	• •	•••			}	16 0	0
5 by 0	6 by 3		•••			)		
4 by 6	6 by 4	•••			••	1	17 0	0
57 by 4						5		-
5 by 6			••		••	••	17 10	0
	DOUB	LE	TE	E I	RON	١.		
3 by 21	3 by 31					]	15 0	0
34 by 2			• •		• •	)		0
47-by 4 by	27	• •	••	••	••	••	16 0	U
	CHA	NN	EL	IF	ON			
3 by 11	4 by 11				••	• •	15 0	0
EXT	RAS ON	AN	IGL	ES	AND	T	EES	
							0 10	0
Bars cut to	er 20 ft., extra			•••			0 10	0

### THE DARLASTON STEEL & IRON COMPANY-continued.

### STEEL.

				£	8.	d.					2	s.	d.
Best Turning T	fool	Steel		 3	0	0	-1	Cotter and Drift Stee	1	 	1	16	0
Best Ingot Cast				 3	0	0	1	Best Cast Rolled Awl	Blade	 	3	0	0
Best Cast Snap	Ste	el		 3	0	0		Best Tack Steel		 	1	14	0
Best Welding (	Cast	Steel		 3	0	0		Cast File Steel		 	2	6	0
Best Cast Tap	and	Die Steel	١	 3	0	0	1	Rubber File Steel		 	1	16	0
Best Double Sh	ear			 3	0	0	-1	Best Cast Gun Lock		 ••	3	0	0
Single Shear				 2	4	0	- 1	Best Gnn Lock		 	1	14	0
Blister Steel				 1	14	0	1	Tilted Key Steel		 	1	5	0

The undermentioned Brands are the Trade Marks and Brands of the Company, and are stamped upon Iron and Steel at their Works, and are used to distinguish the various qualities of Iron and Steel made at the Works.

No. 1.—CHAMPION.

No. 2.—L

DARLASTON

No. 3.—SAMUEL MILLS.

No. 4.—G. F.

G. F.

No. 5.—LLOYD'S DARLASTON.
No. 6.—LLOYD'S CHARCOAL.
No. 7.—L STEEL.

No. 8.— (I)

## STEEL.

### SASH IRON AND MOULDINGS.



379, 380

Secs. 217, 107, 324, 108, 292, 226, 325, 293, 106, 227, 425, 384, 385, 386, 261, 253, 254, 363, 349, 350, 80, 96, 95 ...

### HALF ROUND, OVAL, AND HALF OVAL BARS.

in. and upwards, £13. 10s.; \$\frac{7}{2}\$ in., £14; \$\frac{7}{2}\$ in., £15. \$\frac{1}{2}\$ in., £15. \$\frac{7}{2}\$ in., £15. 10s.; if \$3/16\$ in. thick, extra \$10s.; if \$\frac{1}{2}\$ in. thick, extra £1.

### ADDRESS-

THE DARLASTON STEEL & IRON COMPANY, LIMITED, WEDNESBURY.

15 10 0

By Royal



Command.

# JOSEPH GILLOTT'S

STEEL PENS.

SOLD BY ALL DEALERS THROUGHOUT THE WORLD.

Every Packet bears the fac-simile of his Signature,



# JOHN HORSLEY, IRON AND METAL BROKER.

AND

### COMMISSION AGENT.

ESTIMATES, Prices, Sections, and Drawings forwarded upon application for all descriptions of Machinery, Tools, Iron, Ironwork, and Colliery or Railway Materials.

SPECIFICATIONS AND DRAWINGS COPIED FOR ANY KIND OF WORK IN ANY PART OF THE COUNTRY.

St. Ann's Square,

MANCHESTER.

### DESCRIPTION WITH SECTIONS

OF

## IRON

ROLLED BY

# W. Barrows & Sons

BLOOMFIELD IRON WORKS,

TIPTON,

### STAFFORDSHIRE.

MANUFACTURERS OF ALL KINDS AND SIZES OF

Merchant Iron, Bars, Hoops, Strips, Plates, Sheets, and Tee Iron, &c. &c.

### WILLIAM BARROWS & SONS-continued.

### SIZES.

### FLATS.

in 4	. wide	to 3 in	. thick.	2½ in.	wide to	21 in.	thick.
38	"	16	"	234	"	$2\frac{1}{2}$	"
7	,,	38	,,	3	"	23	37
1/2	,,	7	"	31/4	,,	3	"
9 16	"	$\frac{1}{2}$	"	$3\frac{1}{2}$	"	31	,,
58	"	16	"	33	"	$3\frac{1}{2}$	,,
$\frac{11}{16}$	"	58	"	4	"	$3\frac{1}{2}$	,,
34	"	<u>5</u>	"	41	"	$3\frac{1}{2}$	,,
78	"	58	,,	41/2	"	4	,,
1	"	78	"	434	, "	4	"
11/8	"	1	"	5	"	3	,,
11/4	"	1	"	51	,,	2	"
138	"	$1\frac{1}{4}$	"	$5\frac{1}{2}$	"	2	"
$1\frac{1}{2}$	,,	138	"	$5\frac{3}{4}$	"	$2\frac{1}{2}$	"
15	,,	$1\frac{1}{2}$	,,	6	**	$2\frac{1}{2}$	"
$1\frac{3}{4}$	"	$1\frac{1}{2}$	"	$6\frac{1}{3}$	,,	$2\frac{1}{2}$	"
2	,,	13	"	7	"	11/4	"
21	"	2	,,	71	,,	1	,,

ROUNDS.— $\frac{1}{8}$  in. to 4 in. diameter.

SQUARES.  $-\frac{3}{16}$  in. to  $3\frac{3}{4}$  in. ,,

OVALS.— $\frac{5}{16}$  in. to 1 in. wide; any thickness.

### WILLIAM BARROWS & SONS - continued.

### SIZES.

### HALF-ROUNDS and HALF-OVALS, f. e.

				/	_	_								
wide.	1 in. to	тніск. 3 in.		in.	× ł	in. to	THIC B in		wii 3 ii	-	< 1/8	in. to	THE S	
5 ,, ×	18 "	1 "	9	.,,	× 5/2	"	3 ,	,	7 :	,, >	۲ <u>ا</u>	,,	7	**
3 ,, ×	1/8 ,,	1 "	\$	,, :	× ½	,,	3 ,	, 1	1	,, >	× 13	,,,	12	77
7 ,, ×	3 "	18 "	$\frac{11}{6}$	"	× ‡	"	3 ,	,   1	8	,, :	× 1/4	"	$\frac{1}{2}$	37
1	I in.	×	1 i	in. t	0 1/2	in.	S	ections	11	8	to	120		
1	l½ "	×	1	"	$\frac{1}{2}$	"		"	12	21	"	123		
1	13 ,,	×	38	"	7	"		,,	12	24	"	125		
:	2 "	×	38	"				"	1:	26				
:	21 "	×	38	37				"	1	27				
3	3 "	×	38	"				"	15	28				
	3	×	5						1	29				

### HALF-ROUNDS, Square Edged.



From 1 inch to 3 inches wide. Sections 130 to 186.

### ANGLE IRON, Equal Sides.

From \( \frac{3}{4} \) to 4 inches. Sections 1 to 66.

### WILLIAM BARROWS & SONS-continued.

### SIZES.

### ANGLE IRON, Unequal Sided.

								_					
$1\frac{1}{4}$ in.	×	34	in.	2	2½ in.	. ×	2	in.	$3\frac{1}{2}$	in.	×	3	in.
$1\frac{1}{4}$ ,,	X	1	22	1 8	3 "	×	$2\frac{1}{2}$	"	4	"	×	3	"
$1\frac{1}{2}$ ,,	×	$1\frac{1}{4}$	"	8	31 ,,	×	17	"	4	"	×	$3\frac{1}{2}$	"
2 ,,	X	$1\frac{1}{2}$	,,	1	$3\frac{1}{2}$ ,,	×	$2\frac{1}{2}$	"					
				Se	ection	s 67	to	103.					

### ANGLE IRON, Obtuse.

 $1\frac{1}{R} \times 1\frac{1}{R}$  $1 2\frac{1}{2} \times 2\frac{1}{2} 1 2\frac{3}{4} \times 2\frac{3}{4}$ Sections 104, 105, 106.

### TEE IRON.

1 in.	×	1 in.	$1\frac{1}{4}$ in. $\times 1\frac{1}{4}$ in.	$1\frac{1}{2}$ in. $\times$ 2 in.
1 "	×	$1\frac{1}{2}$ ,,	$1\frac{1}{2}$ ,, $\times$ $1\frac{1}{2}$ ,,	(Beveled top)
11/8 "	×	$1\frac{1}{2}$ ,,	$1\frac{1}{2}$ ,, $\times$ 2 ,,	$2\frac{1}{3}$ in. $\times 3\frac{1}{2}$ in.
			Sections Nos. 107 to 117.	

### BEVELLED TYRE IRON.



From 11 in. to 6 in. wide. Sections Nos. 195 to 218.

### CURVED TYRE and BOAT GUARD IRON.

Sections 187 to 194.

### ROUND-EDGED FLATS.

1 in. to 21 in. wide. Sections 219 to 228.

### BEVELLED and STOCK HOOP IRON.

From 1 to 21 in. wide. Sections 229 to 252.

### FIRE BARS.

From 3 to 4 inches wide. Sections 257 to 263.

SASH IRON. Section 256.

TIP IRON. Sections 253, 254, 255.

# JOHN BAGNALL & SONS,

LIMITED.

# GOLD'S HILL IRON WORKS, WEST BROMWICH.

MANAGING DIRECTOR,

JOSEPH NAYLOR, Esq.

BRAND " 'BAGNALL.'

### JOHN BAGNALL & SONS-continued.

# THE FOLLOWING ARE THE PRESENT PRICES OF JOHN BAGNALL & SONS, LIMITED:—

						Per	r To	n
Bars-	-1 to 6 in	. flat				£	8.	d.
"	$\frac{1}{2}$ to 3 in	. round a	nd squa	are	•••	14	0	0
		$\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$ ,	and 7 f	lats.				
,,	31, 31, 33	, and $3\frac{1}{2}$	in.	•••	•••	14	10	0
	charg	ged accor	ding to	thickne	ess.			
,,	35, 33, 378	, and 4 i	n		•••	15	0	0
(	cut to exac	t lengths	, 5s. pe	r ton e	xtra.			
"	41, 41, 43	, and $4\frac{1}{2}$	in.	•••	•••	16	0	0
"	45, 43, ar	nd 5 in.	•••	•••		16	10	Ò
"	$5\frac{1}{4}$ and $5\frac{1}{2}$	in., rou	nd only	•••	•••	17	10	0
"	53 and 6 i	in	•••	• • •	•••	18	10	0
"	$6\frac{1}{4}$ and $6\frac{1}{2}$	in.	•••	•••	•••	19	10	0
	$\frac{7}{16}$ ,	3,	$\frac{5}{16}$ ,	and	4			
	£14. 10s	., £15, £	£15. 10s	s., and	£16.			
"	$6\frac{3}{4}$ and $7$	in	•••	•••	•••	20	10	0
"	$7\frac{1}{8}$ and $7\frac{1}{4}$	in.	•••	•••	•••	21	10	0
"	7, 8, and	9 in., flat		•••	•••	15	0	0
<b>Furni</b>	ng Bars		•••	•••	•••	14	0	0
Cable	Bars	• • •	•••	•••	•••	14	0	0
Platin	g Bars			•••	•••	14	10	0

### JOHN BAGNALL & SONS—continued.

						£	8.	d.
Best	Bars	•••	•••	•••	•••	15	0	0
Horse	Shoe Bar	'S	•••	•••	•••	15	10	0
В	est Horse Sho	e Bars	, £1 p	er ton ex	ktra			
Best	Rivet Iron		•••	•••		15	10	0
В	est Best Rivet	Iron,	£2. 1	0s.				
Best	Boiler Stri	ips	•••		•••	17	10	0
Hoop	s, 6 to 33 in. wid	de, not	thinne	rthan 14	W.G	. 15	0	0
,,	$3\frac{1}{2}$ to $2\frac{1}{4}$ in.	wide,	"	15	,,	15	0	0
"	2 to $1\frac{5}{8}$ in.	,,	,,	17	,,	15	0	0
"	$1\frac{1}{2}$ to $1\frac{3}{8}$ in.	,,	,,	18	"	15	0	0
"	$1\frac{1}{4}$ to 1 in.	"	,,	19	"	15	0	0
,,	$\frac{7}{8}$ in.	,,	,,	20	"	16	0	0
"	$\frac{3}{4}$ in.	,,	"	20	"	17	0	0
"	$\frac{5}{8}$ in.	"	- ,,	20	,,	19	0	Û
"	$\frac{1}{2}$ in.	,,	,,	20	"	21	0	Û
	Best Ho	oops, £	1 per	ton extr	a.			
	Hoops thinner	than	the g	auges m	en-			
	tioned to	be ch	arged	extra 1	0s.			
	per ton e	each ga	auge t	o 20 W.	.G.,			
	and 20s. p	er ton e	each ga	uge thin	ner			

5s. per ton extra.

Singles, to 20 in. W.G. ... ... 16 10

Doubles, 24 in. ... ... 18 0

than 20 W.G., cut to exact lengths

### JOHN BAGNALL & SONS-continued.

	£	8.	d.
<b>Latten,</b> 27 in	19	10	0
£1 per ton extra for each gauge above			
27 G.W.			
Boiler Plates, to 4 cwt	16	10	0
Best Plates £1 per ton extra.			
Best Best do., £2 per ton extra.			
Plates above 4 cwt. and not exceeding			
5 cwt., £1 per ton extra.			
Do. 5 to 6 cwt., £2.10s. per ton extra.			
Do. 6 to $6\frac{1}{2}$ cwt., £3. 10s. per ton extra.			
Do. $6\frac{1}{2}$ to 7 cwt., £4. 10s. per ton extra.			
And £1 per ton extra for each ½ cwt.			
Plates 15 ft. long and above 4 feet wide,			
£2 per ton each extra.			
Cutting to irregular shapes, £1. 10s.			
per ton extra.			
Angle Rails, 12 to 28 lbs. per yard			
Rails			
Sash Iron			
Angle Bars, 1 to 4 in	14	10	0
Best Angle Bars, 3 to 4 in	15	10	0
Gas Strip, 3 to 6 in. wide	13	5	0
$6\frac{3}{4}$ to $8\frac{1}{2}$ in		15	0
AT OUR WORKS.			

THE

# CHEQUE BANK,

ITS

### OBJECTS AND ADVANTAGES.

### SUBSCRIBED CAPITAL, £200,000.

Trustees of Guarantee Fund of £100,000 Consols.

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ARTHUR J. LEWIS, Esq. (Messrs. Lewis & Allenby).

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City Office.

124 CANNON STREET, E.C.

Money can be paid to the credit of the Cheque Bank at its own Offices or at any of the following Bankers, where the funds of the Cheque Bank will be deposited:—

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THE WESTERN BRANCH OF THE BANK OF ENGLAND,
Burlington Gardens, Bond Street.

GLYN, MILLS, & CO.

WILLIAMS, DEACON, & CO.

NATIONAL PROVINCIAL BANK OF ENGLAND.

DIMSDALE, FOWLER, BARNARD, & CO.

CONSOLIDATED BANK, LIMITED.

ALEXANDERS, CUNLIFFES, & CO.

NATIONAL BANK OF SCOTLAND.

JAY, COOKE, McCULLOCH, & CO.

ALLIANCE BANK, LIMITED.

HERRIES, FARQUHAR, & CO.

R. TWINING & CO.

RANSOM, BOUVERIE, & CO.

CITY BANK.

NATIONAL BANK.

UNION BANK OF SCOTLAND.

MANCHESTER AND SALFORD BANK.

MANCHESTER AND COUNTY BANK.

Additions to this List will be published from time to time.

# RYLANDS BROTHERS,

### LIMITED.

### PRICES OF IRON WIRE, &c.

These Prices are obtained direct from the Firm .- July 10, 1873.



		,					
			T OR ANNE				
Per Bundle of 63lbs.	11s. 9d.	12s. 0d.	12s. 3d.	12s. 6d.	13s. 0d.	13s. 3d.	13s. 6d.
Nos,	0 to 6	7	8	9	10	11	12
Per Bundle of 63lbs.	13s. 9d.	14s. 3d.	14s. 9d.	15s. 6d.	16s. 3d.	17s. 0d.	17s. 9d.
Nos.	13	14	1.5	16	17	18	19
Per Bundle of 60lbs.	18s. 9d.	19s. 9d.	20s. 9d.				
Nos.	20	21	22				
Charcoal Wire	6s. pc	Bundle ex	tra   Cop Wir	pered Wire. e drawn to	pattern	3d. ,,	ndle extra.
Tinded Charcoal Wire	126.	11	" Cha	rcoal Half-r	ound Wire	10s. "	29
	Best	Selected	(RB)	Spring V	Vire.		
Per Bundle of 63lbs.	12s. 3d. 0 to 6	12s. 6d.	12s. 9d.	12s. 9d.	12s. 9d.	13s. od.	13s. 6d. 10
						Bundle extr	
Charcoal Spri Coppered Spri	ng Wire	• • • • • • • • • • • • • • • • • • • •			o. os. per i		a.
Coppered Spri	ing wife				9d.	**	
				(m)			
Best	Best P	repared :	Bright	(⅓) Fe	ncing W	ire.	
	You O	to 6	C1:	9 15 0 p	on Ton		
		to 8		0 15 0			
	•			0 15 0	21		
Best	Best A	nealed	Drawn	(AB) Fe	ncing W	Tire.	
				( 00 )			
Nos. 0 to 6	£18	5 0 per	Ton. No.	10		£21 5 0	per Ten.
7	19	0 0 ,,		11		21 15 (	,,
8	19	15 0 ,,	1	12		22 5 (	) ,,
9		5 0 ,,					
	Dir	ping in boil	ling oil, 5s.	per ton ext	ra.		
				_			
				(m)			
Best	Best Dr	awn Gal	vanized	F	encing V	Vire.	
				( v v /			
Nos. 1 to 6	£22	0 0 per '	Ton.   No.	9		£24 15	per Ton.
7		0 0 ,,		0			
8	23	15 0 ,,					
	Rolle	d w	WI	encing '	Wire.		
				_			
	BLACK.		_		GALVANIZ		-
Nos. 1 to 4		10 0 per :	Ion. Nos.	1 to 4			per Tor.
5		0 0 ,,					0 ,,
6	16	15 0 ,,		6		. 21 0	0 ,,
			(m)				
Best 1	Best Gal	vanized	(B) F	encing S	trand. 7	Plv.	
			(W) -		, .	3 -	
	00 10 1						
Per Cwt. 27s. 9d.	288. 288. 0	d. 29s. 3	0s. 6d. 31s.	. 3d. 32s. 3	d. 34s. 3	5s. 9d. 36s	. 6d. 3%

2 3 4 5 6 7
All Sizes and Plies quoted for on application.

### RYLANDS BROTHERS, LIMITED-continued.

### PRICES OF IRON WIRE, &c.

### Machine-Cut Fencing Staples.

Per Cwt, ..... 22s. 6d. 23s. 0d.

Nos. ...... 5 and 6 Galvanized Staples, 7s. 6d. per cwt. extra. STRAINING SCREWS, 15s. each. Iron Kegs to hold 1 cwt. of Staples, 2s. 3d. each.

Best Best Drawn Killed (R)

Galvanized Telegraph Wire.

(Joined in Half-mile Lengths to No. 9 inclusive with Rylands' Patent Joint.)

Nos. 0 to 6 £24 5 0 per Ton. No. 10 £26 15 0 per Ton. 7 & 8 25 5 ō . . . . . . . . . . 11 27 5 0 0 26 12 28 5 0 Best Refined Telegraph Wire, £3 per ton extra.

Charcoal Telegraph Wire, £10. 10s. per ton extra.

Best Improved

(B) Galvanised Wire.

Per Bundle of 63 lbs. 14s. 3d. 15s. 9d. 14s. 14s. 6d. 15s. 15s. 6d. 168. Nos. 0 to 6 8 9 10 11 12 17s. 9d. 20s. 6d. Per Bundle of 63 lbs. 16s, 3d. 16s. 9d. 18s. 6d. 19s. 9d. 21s. 3d. Nos. 13 14 15 16 17 18 19 5s. 3d. Per Dozen lbs. 4s. 10d. 5s. 9d. 68, 6s. 6d. 7s. 6d. 8s. 3d. 98. Nos. 20 21 22 23 24 25 26 28

Annealed Tinned

Iron Wire.

5s. 9d. 6s. 6d. 78. Per Dozen lbs. 5s. 3d. 5s. 6d. 78. 6d. Nos. 18 19 20 21 22 23 24 . 10s, 9d. Per Dozen lbs. 8s. 3d. 9s. 9d. 26 Nos.

Best Weaving

and Binding Wire.

6s. 5d. 6s. 8d. 4s. 4d. 4s. 7d. 4s. 10d. Sg. Per Dozen lbs. 6s. 11d. 7s. 2d. 23 24 25 26 27 28 Nos. 29 30 7s. 11d. 13s. 10d. 15s. 10d. Per Dozen lbs. 7s. 5d. 8s. 8d. 9s. 8d. 10s. 11d. 12s. 5d. 31 32 361 Nos. 33 34 35 36 37

Charcoal Wire to No. 26, 1s. 1d. per dozen extra.

Bottling Wire cut in lengths, 6d. per dozen extra. Thicker Wire 1s. 6d. per bundle extra.

Wire wound in 1 and 1 lbs. 1s. 6d. per bundle extra; 1 lbs. 2s. per bundle extra.

Wire wound in 1 and 2 oz. hanks, 1d. per lb. extra. Dudley Bagging, 3d., Cotton Bagging, 13d. per bundle extra. Papering, 1d. per bundle extra.

### Delivered Free in Liverpool or Manchester.

If in London, 15s per ton extra, or for 5 ton lots 12s. 6d. extra, f.o.b.

If in Edinburgh, 76s, 8d, per ton extra, or for 2 ton lots 18s, 4d. extra. If in Dublia via Liverpool, 15s, per ton extra. If in Dublin via Holyhead, 18s, 4d. per ton extra.

If in Glasgow :-

By Steamer, 10s, 10d, per ton extra.
By Rail, 21s. 8d. per ton extra, or for 2 ton lots 15s, extra.
If in Hull, 20s per ton extra, or for 2 ton lots 10s, extra.

Terms of Payment.

21 per cent. for cash on 10th of month following delivery.

# IRON WORKS, WOLVERHAMPTON.

BRAND, W. G. M.,



STAFFORDSHIRE.

### WILLIAM G. MERRIMAN

Manufactures at the above Morks

BOILER PLATES,

TANK AND GASOMETER PLATES,

### WILLIAM G. MERRIMAN-continued.

# RUSSIAN ROOFING SHEETS, SHEETS FOR GALVANIZING

AND ALL OTHER PURPOSES,

BEST, BEST BEST, AND BEST BEST BEST.

ALSO

## ALL KINDS OF SHEET IRON

FOR STAMPING PURPOSES,

HOOPS OF ALL KINDS,

AND

Strip for Locomotive and Gas Tubes,

BARS, ROUNDS,

SQUARES, AND FLATS,

BEST AND BEST BEST

# CONSETT IRON COMPANY,

LIMITED,

## CONSETT. DURHAM.

THIS COMPANY ARE

# COAL OWNERS AND MAKERS OF COKE, PIG IRON. RAILS.

AND

PLATES FOR SHIPBUILDING AND ENGINFERING
PURPOSES.

They Manufacture Plates of the Highest Quality, such as are used by the English and Foreign Governments.

THEY CAN PRODUCE

### 1,200 TONS OF PLATES WEEKLY.

OFFICES-

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LONDON: 118 CANNON STREET.
GLASGOW: 166 BUCHANAN STREET.
NEWCASTLE-ON-TYNE: 19 GREY STREET.

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(ESTABLISHED 1854),

MANUFACTURERS OF

# CHILLED AND GRAIN ROLLS,

TOOTH WHEELS,

SHAFTING, & MILL & FORGE Castings in General.

ROLLS TURNED TO ANY SECTION AND FOR ANY PURPOSE.

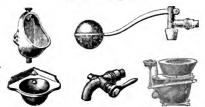
TRAINS OF ROLLS FITTED UP COMPLETE.

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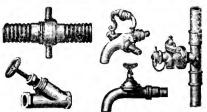
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# HAYWARD TYLER & Co., SANITARY ENGINEERS,

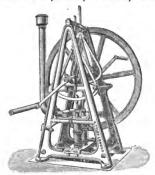
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CLOSETS, URINALS, AND LAVATORY FITTINGS.



HYDRANTS, TAPS, VALVES, AND BRASS WORK OF ALL SORTS.



DEEP-WELL PUMPS AND FRAMES.



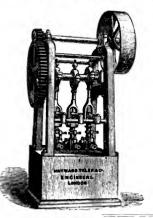
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### GENERAL ENGINEERS,

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### HYDRAULIC PRESSES

FOI

COTTON.

WOOL.

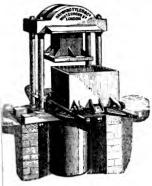
HAY.

HIDES.

OILS.

SEEDS.

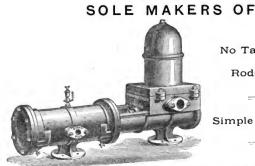
ETC. ETC.



BOILER PROVERS,
GAUGES,
SPRING BALANCES,
SAFETY VALVES,
STEAM ENGINES,
BOILERS,
AND STEAM FITTINGS.

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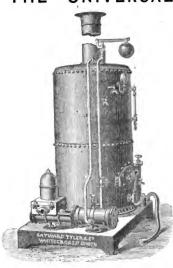
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No Tappet-Valves,
Rods, or Gear.

Simple and Efficient.

### THE 'UNIVERSAL' STEAM PUMP.



THE ONLY
DIRECT ACTING
STEAM PUMP

IN THE

VIENNA EXHIBITION OF 1873

WHICH WAS AWARDED

Inc

GRAND PRIZE **MED**AL OF PROGRESS

AMONGST THE

ENGLISH EXHIBITORS.

### HAYWARD TYLER & Co.

(ESTABLISHED 1815),

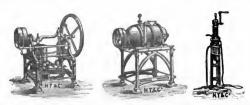
THE OLDEST MAKERS IN THE KINGDOM OF

### SODA-WATER MACHINERY

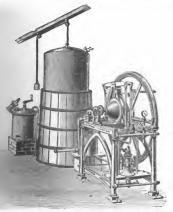
IN ALL ITS BRANCHES,

84 AND 85 UPPER WHITECROSS STREET,

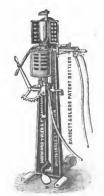
LONDON.



PUMPS, GAS GENERATOR, AND BOTTLING MACHINE



SODA-WATER MACHINE.



PATENT BOTTLING MACHINE.





VIENNA, 1873.



PARIS, 1867.

### THE

# PATENT NUT & BOLT CO.

LIMITED.

### THE PATENT NUT AND BOLT CO.

Continued.

MANUFACTURERS OF ALL KINDS OF

# RAILWAY FASTENINGS,

INCLUDING

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SOLE PLATES, FISH BOLTS,

FANG BOLTS,

AND

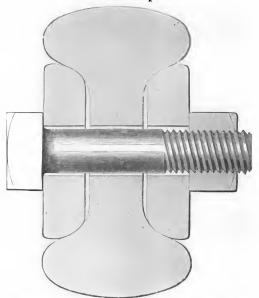
STRAP BOLTS,

CUP HEAD AND DOG HEAD SPIKES.

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Boulons, Ecrous, Crampons, Eclisses et Placques de Jointes.

Boltzen, Muttern, Nageln, Laschen und Anterlags, Platten.



NUTS AND BOLTS, RIVETS, COACH SCREWS, WASHERS,

SMITHS' IRONWORK
OF EVERY DESCRIPTION.

### THE PATENT NUT AND BOLT CO.

Continued.

### WORKS:

London Works, Birmingham.

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40 Sandhill, Newcastle-on-Tyne.
10 Norfolk Street, Sheffield.
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CHIEF OFFICES, LONDON WORKS,
NEAR BIRMINGHAM.



# GEO. STRATHERN & CO., IRON AND METAL BROKERS

AND

COMMISSION AGENTS, 29 WATERLOO STREET, GLASGOW.

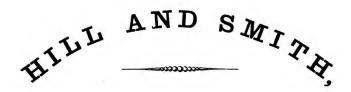
Agents for the Sale of every description of Iron, Iron Wire, Iron and Steel Wire Ropes, Tin Plates, Pig and Sheet Lead, Red and White Lead, Litharge, Copper, Zinc, Spelter, &c.

# EDMUND DENT, BANK TERRACE, HECKMONDWIKE,

IRON AND METAL MERCHANT AND BROKER.

General Commission Agent for Brass, Copper, and Iron Tubes of every description, Bolts, Nuts, Screws and Nails, Locomotive Engine Frames, Wheels, and Axles, Springs, Steel, &c.

Agent for W. H. and Geo. Dawes, Milton and Elsecar Iron Works, near Barnsley; also the Trent Iron Company, and the Denby Iron Company.



### IRON WORKS, BRIERLY HILL,

MANUFACTURE

WROUGHT IRON SHAFTS,

CRANK SHAFTS FOR MARINE ENGINES,

PISTON RODS, CONNECTING RODS,

all use iron of the largest weights and sizes.

MANUFACTURERS BY APPOINTMENT

OF

GRIFFITHS' PATENT PUDDLING MACHINE.

HURDLES AND IRON FENCING OF ALL KINDS,

INCLUDING

WIRE FENCING FOR PARKS AND ESTATES.

PRICES FOR FENCING PARKS AND ESTATES WILL BE FORWARDED TO NOBLEMEN AND OTHERS TO ANY PART OF THE UNITED KINGDOM ON APPLICATION.

ORDERS FROM STOCK EXECUTED ON RECEIPT.



#### DEPOT FOR THE

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Patent 'Sicker.' Double Grip Bolt Fire and Burglar Proof Safes,

MANUFACTURED BY

## JAMES FELTON ELWELL, vulcan works, BIRMINGHAM.

Inventor, Patentee and Sole Manufacturer.

#### LIST OF PRICES FREE ON APPLICATION.

J. E. Gives Best Price for Second-hand or Rejected Rails, also Cast and Wrought Iron Scrap. The "Sicker"
Double Trip Bolt Safes. Strong.
Room Doors to for Barkers.
Jewellers. Merchants to
Sire, Wedge, Dull Bunpower two f



The only clases manufactured which effectually resident Turc and the felled tourglar manufacturers sames tellon Clovelly Melan Horks, tourninghams

# W. MILLINGTON & CO.





#### SUMMER HILL:

# IRON WORKS,

#### STAFFORDSHIRE,

MANUFACTURERS OF .

Bar Iron, Plating, Horse Shoe, Sheep Shear, Chain and Scroll Iron. Small Rounds, Squares, Half Rounds, Half Ovals, Ovals, Fender Mouldings, Fencing and Drawing Wire,

AND OF

Angles, Rivet Iron, and Boiler Plates,

Of Best, Best Best, Treble Best, and Tieble Best L.M. Qualities.

# THOMAS L. NICKLIN, CROWN IRON WORKS, SMETHWICK,

MANUFACTURES

BARS, ANGLE IRON,

SMALL ROUNDS AND SQUARES,

PLATING BARS, AND RIVET IRON,

BEST AND BEST BEST,

IRON OF ALL KINDS.

POSTAL ADDRESS,

SMETHWICK.

All trains stop at SMETHWICK STATION, which is distant only five minutes' walk from the Works.

PATENTEES.



# JOHN & EDWIN WRIGHT

#### MANUFCTURERS OF

#### EVERY DESCRIPTION OF IMPROVED

#### PATENT FLAT & ROUND WIRE ROPES

From the very best quality of Charcoal Iron and Steel Wire;

#### PATENT FLAT & ROUND HEMP ROPES,

Ships' Rigging; Signal and Fencing Strand;

Lightning Conductors; Steam Plough Ropes, made from

Webster & Horsfall's Patent Steel Wire; Hemp,

Flax, Engine Yarn, Cotton Waste,

Tarpauline, Oil Sheets, Brattice Cloths, &c.

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UNIVERSE WORKS:-

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MAKES AT

#### WINDMILL END FURNACES

Nos. 1, 2, and 3

# MELTING PIG IRON,

Strong Forge Mine Iron,

AND

OTHER KINDS OF PIG IRON.

The Earl of Dudley's THICK COAL is used.

ILLIAM ROSE, IRON-MASTER, OSE,

# BATMAN'S HILL IRON WORKS,

BRADLEY,

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